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ABSTRACT

The Task Force on Women, Minorities, and the Handicapped in Science and Technology was established by the U.S. Congress in Public Law 99-383 with the purpose of developing a long-range plan for broadening participation in science and engineering. Public hearings were held in Albuquerque (New Mexico), Atlanta (Georgia), Baltimore (Maryland), Boston (Massachusetts), Chicago (Illinois), Kansas City (Missouri), and Los Angeles (California) between Fall 1987 and Spring 1988. The final report of the task force was produced in December, 1989. This document is the verbatim transcript of the public hearing. Co-Chairs Mr. Jaime Oaxaca and Dr. Ann Reynolds presided over the hearing. Following opening comments from the chair, speakers at this hearing included: (1) Dr. Jon D. Miller; (2) Dr. William L Lebold; (3) Ms. Christa Lane Larsen; (4) Dr. Ted Ansbacher; (5) Dr. Elaine Copeland; (6) Dr. Robert Springer; (7) Dr. Anibal Taboas; (8) Dr. Arlene Lennox; (9) Ms. Jane Daniels; (10) Dr. Izaak Wirszup; (11) Dr. Thomas L Martin Jr.; (12) Dr. Yvonne Walker Taylor; (13) Dr. Thomas Kucera; (14) Dr. Marion C. Thurnauer; (15) Dr. Richard Neblett; (16) Dr. Donald Langenberg; (17) Mr. Cecil Curtwright; and (18) Ms. Carolyn Stern. (CW)

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ED317393

DEPARTMENT OF HEALTH AND HUMAN SERVICES
TASK FORCE ON WOMEN, MINORITIES AND THE HANDICAPPED IN SCIENCE AND TECHNOLOGY

PUBLIC HEARING

REPORT OF PROCEEDINGS of a public hearing of the Task Force on Women, Minorities and the Handicapped in Science and Technology held at the hour of 9:35 A.M. on the 29th day of October, 1987, at 300 South Wacker Drive, 35th Floor, Chicago, Illinois and presided over by MR. JAIME OAXACA AND DR. ANN REYNOLDS, CO-CHAIRMEN.

PRESENT:

Co-Chairs

Mr. Jaime Oaxaca, President
Wilcox Electric, Inc.
Kansas City, MO

Dr. Ann Reynolds, Chancellor
California State University System
Long Beach, CA

Members Present

Dr. Howard G. Adams, Executive Director
National Consortium for Graduate Degrees in Engineering, Inc.
Notre Dame, IN

Mr. Lehman F. Beardsley, Chairman of the Miles Foundation
Miles Laboratories
Elkhart, IN

Dr. Kenneth Bell, Associate Administrator for Extension
Delaware State College
Dover, DE

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Dr. E. Ann Berman, Deputy Assistant Secretary of
the Applied Science
The Pentagon
Washington, D.C.

Mr. James A. Biaglow, Project Engineer
NASA Lewis Research Center
Cleveland, OH

Ms. Ferial Bishop, Chief of Registration Support
and Emergency Response Branch
Environmental Protection Agency
Washington, D.C.

Jo Anne Brasel, M.D., Professor of Pediatrics
Harbor UCLA Medical Center
Torrance, CA

Dr. Mary E. Carter, Associate Administrator
U.S. Department of Agriculture
Washington, D.C.

Dr. Alan Clive, Office of Personnel and Equal
Opportunity
Federal Emergency Management Agency
Washington, D.C.

Dr. Mary E. Clutter, Division Director
National Science Foundation
Washington, D.C.

Dr. Joseph G. Danek, Deputy Director for Research
and Improvement
National Science Foundation
Washington, D.C.

Mr. Herbert Fernandez
AFWL/NTS Kirtland AFB
Albuquerque, NM

Ms. Claire E. Freeman, Deputy Assistant Secretary
of Defense for Civilian Personnel Policy
Washington, D.C.

Ms. Stella Guerra, Director of Equal Opportunity
The Pentagon
Washington, D.C.

Dr. Ruth A. Haines, Deputy Director
Center for Chemical Physics
National Bureau of Standards
Gaithersburg, MD

Ms. Penelope M. Hanshaw, Deputy Chief Geologist
for Scientific Personnel
Department of the Interior
Reston, VA

Ms. JoAnn Sondey-Hersh, Personnel Officer
U.S. Department of Commerce
Washington, D.C.

Mr. Norbert Hill, Executive Director
American Indian Science & Engineering Society
Boulder, CO

Ms. Amoretta H. Hoeber, Director of Planning and
Development
Fairfax, VA

Dr. M. Carl Holman, President
National Urban Coalition
Washington, D.C.

Mr. James Jeffers
Baltimore, MD

Dr. Harriett G. Jenkins, Assistant Administrator
National Aeronautics and Space Administration
Washington, D.C.

Ms. Antionette G. Joseph, Associate Director
Office of Energy Research Department of Energy
Washington, D.C.

Mr. Robert Cyrus Laughter, Chairman of the Board
Laughter Corporation
Dayton, OH

Ms. Fran Lopes, Assistant Director of Recruiting
and Special Personnel Programs
Washington, D.C.

Dr. Shirley Malcom, Program Head
American Association for the Advancement of Science
Washington, D.C.

Mr. Frank B. McDonald, Associate Director
National Aeronautics and Space Administration
Greenbelt, MD

Ms. Stephanie Lee-Miller, Assistant Secretary for Public Affairs
Department of Health and Human Services
Washington, D.C.

Mrs. Barbara Morgan, Coordinator for Teachers in Space
NASA Code XEE
Washington, D.C.

Mr. Robert H. Morris, Deputy Director
Federal Emergency Management Agency
Washington, D.C.

Dr. Norine Noonan, Acting Branch Chief
Science and Space Branch
Washington, D.C.

Ms. Kathleen Peery, Legislative Specialist
Department of Energy
Washington, D.C.

Dr. Percy A. Pierre, President
Prairie View A&M University
Prairie View, TX

Mr. Raul Ernie Reyes, Director Quality Assurance
NASA Mail Code RO
Kennedy Space Center, FL

Dr. Meguel Rios, Jr., President
Orion International Technologies, Inc.
Albuquerque, NM

Ms. Gloria R. Sabatini
Washington, D.C.

Dr. Lawrence Scadden, Director Rehabilitation
Engineering Center
Electronic Industries Foundation
Washington, D.C.

Mr. Nathaniel Scurry, Director of the Office of
Civil Rights
Environmental Protection Agency
Washington, D.C.

Mr. Curtis J. Smith, Associate Director for Career
Entry
Office of Personnel Management
Washington, D.C.

Mr. Alvin Thomas,
Federal Aviation Administration
Washington, D.C.

Ms. Sonia Mejia-Walgreen
Mansfield, MA

Ms. Miriam (Gully) Walter, Executive Director
Department of the Interior
Washington, D.C.

Dr. Luther Williams
National Institute of General Medical Sciences
Bethesda, MD

Ms. Vera (Nina) Winkler, Deputy Director
U.S. Department of Education
Washington, D.C.

Ms. Sue Kemnitzer, Executive Director
Task Force on Women, Minorities and Handicapped
Washington, D.C.

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Chicago, Illinois

ELDNA HUDSON, Verbatim Reporter

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CHAIRMAN OAXACA: Let me welcome all the people who have come here to testify in front of the Task Force on Women, Minorities and the Handicapped in Science and Technology.

I am your Co-Chair, Jaime Oaxaca. I'm with the Northrop Corporation and let me give you some of the ground rules.

Each person that will be testifying will be given ten minutes.

One of the persons will ring a little bell when you have a minute to go and then the hook will get you.

(LAUGHTER)

CHAIRMAN OAXACA: Those folks that will be testifying from the floor that have not been scheduled are allowed three minutes, but we also encourage you to submit your written testimony under those conditions.

We have some very distinguished folks testifying. This is the second public hearing.

We're going to be doing this

throughout the country on what is a very, very important issue that is no longer, to quote Betty Vedder, "It's no longer a moral issue, it is an issue of national survival."

If we don't solve this problem in a timely fashion, we will fall further behind in the world competitiveness.

And beyond that, we will get into the dilemma that, based on the facts and the demographics in our country, we will be in a world where the population will be much more unskilled than it is today and that would be a tragedy.

So we'll get the hearing started now. I would like to read a letter addressed to Dr. Ann Reynolds, who is the Co-Chair and the members of the task force and it's from Governor James R. Thompson, the Governor of the State of Illinois.

"Dear Mr. Oaxaca and Dr. Reynolds.

As Governor of the State of Illinois, I extend best wishes and greetings to the members of the task force as you hold your important meetings in Chicago.

I regret that my schedule prevents my being with you today, but I want to express my support of your efforts to broaden participation by women, minorities and the handicapped in science and technology.

This work is vitally important to the future competitiveness of our state and country.

On behalf of the people of Illinois, I welcome you and wish you well."

So with that as the kick-off, I would like to ask Dr. Jon D. Miller, Director of Public Opinion Laboratory of Northern Illinois University, as our first person to testify on attitudes of women toward science and technology, young students and career expectations, welcome to our hearings, Dr. Miller.

DR. MILLER: Thank you Chairman Oaxaca, Chairman Reynolds and members of the Task

Force.

I come to you both as Director of the Public Opinion Laboratory, a group that has done a good deal of work on public understanding of science and technology and as Director of a new NSF funded project to study the development of attitudes and career plans of middle school and high school students towards science and technology over the next four years.

Some of what I am going to say is based on data we already have collected, some of it are informed speculations about what we think is happening in this process.

In all regards, we think there's a lot more to learn about this process for which young people decide to pursue science and technology or to avoid science and technology.

And so what we are involved with is reporting to you today on some thoughts and work which we are currently engaged, which we have certainly not completed, certainly have not completed.

I really would like to focus your attention to two aspects of involvement in science and technology.

One aspect is the aspect that I read in your mandate and some of your previous papers, this concerns the development of career aspirations, in particular, professional career aspirations;people who want to be scientists and engineers at professional levels.

That's certainly a very appropriate focus for your work and no doubt that is, will be a major part of what you have to do.

I would also ask you to focus a part of your effort on a second form of involvement in science and technology, which is that of the citizen.

It is undeniable that a large number of issues on our political life involve science and technology issues; issues ranging from nuclear power to incomminant DNA, to the desirability of building super, super-conducting super colliders and all sorts of issues.

And in this the 200th year of our Constitution, we should be, I think, conscious of the tension and threat to democracy in my view of the political system in which large numbers of people are scientifically illiterate and largely unable to perform some of the duties of citizenship.

And I think that women, minorities and the handicapped, by all of our majors, are among the most likely to be scientifically illiterate and therefore most disadvantaged in playing full citizenship roles in that regard.

So I would commend to you a second aspect of your work, which is to think about the role of the groups that you are studying in regard to their citizenship responsibilities.

Let me turn back to the issue that I think has been of primary concern to your task force, which is the process by which young people and particularly women, minorities and the handicapped students begin to think about and to decide to pursue or not to pursue careers in science, mathematics and engineering.

There are a couple of things I think that you need to start with is general observations which I think are oftentimes misunderstood.

First, I think that the process, the decision-making process, the critical points in the decision-making process occur much earlier than we have been led to believe traditionally and that maybe and certainly much earlier than for many other kinds of occupations.

We all know that there are points in a child's career, particularly during high school years when we think of career days and college days and so forth.

I would suggest to you that the decision points for a person who wants to be a professional scientist or engineer come much before that, much more likely in the middle school years.

At the risk of oversimplying the process, let me make this argument to you.

When a seventh grade student is placed in a math track that begins to emphasize computation and long division rather than pre-algebra, the door to a career in science and technology is beginning to close.

When an eighth grade student fills out their class form and takes general math rather than algebra, that door to science and mathematics and engineering is closing further.

And when a student completes the tenth grade of school, their sophomore year of high school and have not yet completed a year of algebra, for 99% of our students, the door to science and technology career at the professional level is closed.

There may be one percent who would be persistent enough to elongate either their high-school career or their college career to take the algebra, geometry, advanced algebra and pre-calculus that will be necessary to be admitted to a college program in science or mathematics, but 99% of the students will not make that sacrifice and elongate their career by two or three years, their formal study by two or three years to get back into that chain.

So that there are some indeed, I guess the point is not the students have to make an absolutely iron-clad decision in the seventh grade to become scientist, but if they make a series of wrong decision at that point, they preclude the opportunity to become scientist at a later date.

I think we need to understand that there are critical junctures very early in the process, earlier in this process than would be true for many other professions.

The second thing I would like emphasize is what I think is a certain all or nothing characteristic about science, particularly in engineering to some extent.

We know, for example, that a person who does half of a law school curriculum cannot practice law and a person who does half of a medical school curriculum cannot practice medicine and we know that because of licensure.

The fact of the matter is, science is pretty much the same way. People who have half way finished formal training in science may become technicians or technologists, but they don't become scientists very often.

There may be a few exceptions in our generation, there will be almost no exceptions in our children's generation and virtually none in our grandchildren's generation.

We must think, not only of recruitment of people to science and technology, but we must think of the persistence and retention of students in science and technology and particularly when you're talking about increasing the portion of women, minorities and handicapped students who complete programs in science, mathematics, engineering.

You must not only of recruitment, but its particularly important to think of persistence of retention.

And those, I think, are much more

complex issues and much more difficult objects to achieve, but I think that your task force must focus on those and consider those.

Because many of the barriers, the all-student space will be in some cases magnified and enlarged for students in the groups that you are primarily concerned about.

Let me say, we do, although we have a lot more we want to learn about this process by which young people make these decisions, we do know some things about them, about the process and some of the structural problems that occur in it.

One of the problems is the problem I've just alluded to, which is that the broad misunderstanding that career decisions really occur in the junior and senior year of high school.

We structure a lot of our school efforts at career counseling at that point. In my view, knowing -- students misunderstand that, parents misunderstand it and unfortunately teachers and counselors often misunderstand it.

There is, I think, a very pervasive misunderstanding of the criticalness of those early decisions, particularly in regard to taking mathematics.

Secondly, there is the unfortunate coincidence that those middle school years, the junior high school years are the point in our school systems generally across this country at which communications between schools and parents diminish and stops largely.

It's a structural problem. When you have in K6 or K5 and you have one teacher per classroom, you have conferences every year and most school systems want you to have conferences, some of them even mandate conferences.

You go to school once or twice a year and the teacher talks to you about your child's progress and about the problems and what you can do to help and so forth.

Once you get to middle school, they have an English teach and a Math teach and a Science teacher and a Social Studies teacher; they stop conferences.

Probably because they don't know how to handle four or five students in this and if you're lucky, they'll have a parents night early in the school year where you can come, you can stand in the auditorium and they'll say, "This is your algebra teacher and this is your math teacher and this is your science teacher."

But you don't get the kind of conferencing and the kind of individual discussions you get at the K6 level.

And it's unfortunate because just at the point when parents ought to be more concerned and more knowledgeable and when parents ought to be involved in that process, they're largely excluded from the process.

And throughout this country, we have essentially no real formal mechanisms to involve parents in dialogues with schools beyond the sixth grade level, except for disciplinary and behavioral problems.

We do not have parents talking to

students and to counselors and teachers, except the fact if you call the middle school and say, "Can I schedule a conference." They say, "Is there a problem?" Because they don't expect to see parents coming in at that point.

And for purposes of science and technology, these are critical years and it's important that parents and schools communicate a much more effective and formal way than they do.

Those school years are also years when tracking becomes very real and very, and has enormous consequences.

Particularly at that point, there's a lot of math tracking going on and a lot of times that math tracking is unfortunately based on verbal testing, not necessarily on quantitative testing.

A lot of our tracking is still based on -- tests that are largely vocabulary based and when you add those things together, you find students entering the middle schools, you find them encountering tracking systems, tracking systems that are largely invisible to parents and students.

Many students don't know they're being tracked, they just know during 4th period mathematics, they don't know whether 4th period mathematics is really different than 6th period mathematics and they don't have any idea where they're doing pre-algebra or where they're doing long division and sometimes they use the same book, they just get very different piecing.

So there's a lot of critical decisions that are occurring at a point in which there's really not much central thought or control about the process.

Even teachers and counselors at the middle school level tend to let those decisions be made pretty much automatically by standardized test scores or they don't seem to have a great grasp in making career decisions at that point; they think there's still lots of time to make up for those things.

And I think there's not a sense of

an awareness of, sense of the critical nature of those middle school, high school years. And particularly the first two years of high school and the seventh and eighth grades.

So I think that there are some important structural problems there and all those structural problems are magnified for, I think, women students, minority students and handicapped.

Let me say at the outset, I have almost no data about handicapped students. I have very little experience.

And so almost all of my remarks pertain really to women students and minority students, simply because of the limits of my own experience.

But in regard to women and minority students, I think that we know that families are very important. We know that families are important to all students in this career-making process.

We know that parents who have a strong and positive view of science and technology take their children to museums and buy them toys to encourage them in these regards.

Send children to school who want to take science and mathematics and probably there's very little the schools can do to truly discourage that.

On the other hand, there are parents who have very negative views about science and technology. They may see it as a threat to their religious beliefs, they may see it as a complex thing that they don't think that they or other ordinary people can understand.

And if they transmit those negative views to their children, that will very likely be effective in their ultimate career decisions also.

In some cases where the parents are neutral, which is probably about half the cases, the schools have an extraordinary opportunity and oftentimes we hear stories of mentoring, where a person had an extraordinary high school chemistry teacher or someone who then changed their life in some fashion.

We think that occurs when students are basically, are not receiving strong home guidance.

But the effect for women and minorities is that many of these processes require parents who have the intellectual and other resources to bring to bear pressure on the school system, who watch the tracking decisions to encourage their students to take the kinds of mathematics and things they ought to be taking.

It requires, I think, a rethinking and restructuring of a number of school-related activities in those middle years.

And I would hope that your task force would give some serious thought to that. I think that focusing at the end of the high school year is too late.

And if you're serious about creating more opportunities for people to become professional scientists and engineers, I think those middle school years and the early high school years are very, very important.

CHAIRMAN OAXACA: Thank you, so much.

I would ask the task force if they have any questions for Dr. Miller.

Ms. Freeman?

MS. FREEMAN: When a young student, say twelve or thirteen is given a variety of tests to ascertain their ability to do well in a higher math course structure and they do okay; that is they show that they have a superior advantage, but they're not great.

I have had anecdotal information to say that when the student is slightly above average, but not, you know, a superstar, that they are discouraged from pursuing the science or math track, because they're not going to be a superstar.

And yet, my feeling is and I'm asking if you agree that, those kind of good students or whether they are Grade A students or not would be valuable in the science and technology career environment.

And I guess I'm asking, is there a systematic discouragement of students who like math, who do well in math, but aren't necessarily brilliant.

DR. MILLER: Yes. Let me say that that, it's very hard to say definitively exactly how the tracking decisions are made in this country.

We have sixteen thousand school boards across the country and a lot of different test vendors and lots of ways that people are classified and lots of school systems that aren't very good at telling you exactly how they do their tracking.

So that it's very hard to make absolute, iron-clad statements about that. But my impression is that the federal legislation in regard to gifted and talented students has had a particularly, I think, devasting effect on tracking systems.

What is, order to qualify for that funding, which usually focuses on the top five percent, the definition has been very narrow.

And as a result of that legislation, which gives school districts money for what is called gifted and talented and defines that as five percent, as opposed to thirty percent or whatever.

I mean, I think that that's an extremely short-sighted view of giftedness and talentness.

And it turns out, in many schools, the upper level tracking, the pre-algebra mathematics, particularly, is limited to the gifted and talented students.

And we know from all sorts of data that that data, those test selections are extraordinarily eschewed against women and minority students.

So I think there is indeed a sorting out at that point, where average students or slightly above-average students are going to go into a math curriculum.

I would recommend to you the

report, if you have not seen it, of the National Academy of Science. It's called Inter-Achieving Curriculum, which is an extremely good report on mathematics in the United States, in which they compare the United States and Japan and concludes, essentially, that we are the only industrialized country in the world that takes five years to teach long division.

(LAUGHTER)

DR. MILLER: And what we tend to do in the middle school is to spend an awful lot of time taking students who are average and slightly above average and doing decimals and fractions adnauseam.

And I think that that's a serious problem that has the effect of not moving people up to algebra at a point when they really are intellectually prepared to do so.

MS. FREEMAN: Would you have any recommendation on how we would approach a systemic, how we would approach this particular problem; that is, the tracking, the problem/discouragement problem on a systemic national?

DR. MILLER: Well, one is, I think it's important to not tie federal funding for gifted and talented to five percent. I think that's an extremely narrow conception of talent in this country.

And in a sense, what it was designed to do was to recognized people who are of extraordinary intelligence, which probably was in a couple of percentage points.

But the fact of the matter is that most of those programs are programs that would benefit certainly the upper half of the students in terms of ability, if not the upper two-thirds of them.

The programs are of a character that many, many more students could benefit from, so one of the ways to do it systemically would be to break the five percent barrier, which a federal task force could certainly open some effort on and to try to get a broader definition.

And also to make sure that the methods of selection for that process are not tied to verbal scores. Because the one thing we know about verbal testing is, that the best predictor of verbal scores is your parent's education. And what you're doing is testing social class.

CHAIRMAN OAXACA: One last question. Dr. Danek?

DR. DANEK: Thank you. I was intrigued by your comment of elongation and that is, since the majority of, as you said, 99% of minorities and women or most kids have opted out of science by not taking algebra by tenth grade.

Do you know of any exempliary (sic) programs which try to diminish the negative effects of elongating one's high school education to five or six years?

I mean, we seem to have no problem with red shirting people in college and keeping them in college for five or six years and they're proud of it.

But yet, to keep a kid in high

school for six years is a disaster.

DR. MILLER: Yes.

DR. DANEK: Now, why can't we, are there any exempliary (sic) programs like academic red shirting in high school --

MS. FREEMAN: Or junior high.

DR. DANEK: -- have not had the background in math, but have high potential. And can you turn it from a negative thing into a positive thing?

DR. MILLER: I'm not aware of any high school program. I think what happens is, the students who do elongate their careers and play catchup, do it at the college level by taking five and six years of algebra --

DR. DANEK: That's right.

DR. MILLER: I don't know of any successful high school programs, because as you know, there's enormous social pressure and other things to graduate on time and that sort of thing.

It seems to me that it wouldn't take a great deal of social imagination though to figure out how to do summer camps and lots of other interventions where you could in fact find ways to play catchup within the high school years that we could think of much more creatively than we do. I mean, I think there's opportunities in that time structure to do it.

The fact of the matter is, I don't know of any programs that do it very well.

CHAIRMAN OAXACA: Dr. Jenkins?

DR. JENKINS: Yes. Dr. Miller, before you leave, as -- Director of Public Opinion Laboratory, do you have any ideas about how we can turn the country around, mobilize and empower parents to demand a better education in the public schools, particularly at the elementary level, so that when they get to seventh grade, they have a decent background?

DR. MILLER: Well, I think that the parents are already in ahead of it, ahead of it. The last time, a survey I did for the National Science Board in regard to public attitudes towards science and technology, we asked a national sample of American adults if they thought the high school student should take four years of mathematics and four years of science.

And about ninety percent of American adults said yes.

DR. JENKINS: So how do you get the boards of education to deliver, especially for minority parents and minority schools?

DR. MILLER: Well, that's an exceedingly difficult problem.

You know, American education is decentralized into local districts and for minority students, as I say, in the written remarks I give you, the other irony of life is that most minority students are in large urban school systems, which are characterized by a high degree of resistance to parental influence, because of their large and somewhat bureaucratic structures.

Whereas small school systems with elected school board tend to listen to parents a little bit more, because that's the nature of small democratic systems.

In principle, I think, smaller systems would help if I had to structure it in some way.

And I think that big systems are always going to be, as any big organization, whether it's a big corporation or a big university or a big anything, tends to be harder to influence for the individual.

I think smaller systems are probably more easily influenced by concerned parents.

CHAIRMAN OAXACA: Dr. Miller, thank you so much for your testimony.

DR. MILLER: Thank you for this opportunity.

CHAIRMAN OAXACA: I'd like to ask Dr. William K. Lebold, the Director of Engineering and Education and Research Studies at Purdue University to come up.

They tell me that the University of Indiana might beat you this year.

DR. LEBOLD: We've got our fingers crossed.

(PAUSE AS VISUAL AID IS SET UP)

DR. LEBOLD: While we're waiting, I might, I had a second thought on that and what I'd like to talk to you today about would be cooperation rather than competition, because I think that's what we're going to need in order to meet the very important part and charge this particular task force.

And it's on that vein that I'd like to give my remarks --

CHAIRMAN OAXACA: Are we okay now. Are we, to the degree that we record all the things that go on, because we want to make sure we catch every word for the report.

So the clock's started. Dr. Lebold?

DR. LEBOLD: Thank you very much. I'd first like to commend all of you for dedicating your time to this very important problem.

And that is the role of women and minorities and I always have some problems whether we should say handicapped and disabled, but my contact with what might be called disabled, are very abled people.

And if you'll, I'll probably use a number of these different terms today.

I would like to, first of all, I've been at Purdue for about thirty years and been, devoted most of my career to the study of engineers.

In the context of my remarks, I would like to focus primarily on engineering.

There are a number of different reasons why engineering is in very important focus. And one of the reasons is that two-thirds of the science and technology occupation, work force are engineers.

There are over 2.2 million out of 3.3 million, according to the latest NSF report; that was as of 1984.

Another reason, and this is one of

the things I'd like to use the view-graph here, if I can, why I think engineering is very important is that we've had some phenomenal growth in the last few years in the number of BS, MS and Doctorates awarded to women in engineering.

And yet engineering still lags behind all the other disciplines in the percentage of women.

And to some extent, although I don't have the charts exactly to support this, it is also true with regard to minorities, particularly the underrepresented minorities -- Black, Hispanic and American Indian.

If one looks in the engineering context, at beginning first year students, and we like to track at that particular level, I think there's another very important reason why engineering is worth examining.

Because we have a special problem in that Asian Americans are overrepresented in engineering and we have a very large international student population, not only among students and recipients of BS, MS and Doctors degrees, but also among our faculty.

And this very important. That's why, again, I'd like to stress, it's not competition that we should be talking about, but cooperation, because they are very vital and important resources --

We played around, and in this particular chart, I've simply taken the first year BS, MS and Doctor levels to try and give you some kind of a context for which you might be able to examine.

You can see that women are quite represented at the graduate level, but we're all very much concerned about the fact that the number of women has not been increasing for the last four or five years in engineering.

And that's coming in the pipeline. You still see the increases at the baccalaureate level and to some extent at the Masters and Doctors level for women, but it's because we're taking advantage of that -- growth.

So one of the things that this committee may want to do is, and I'd like to emphasize the kind of work that Dr. Miller mentioned earlier, what's coming in in the pipeline and the pipeline before the first year or beginning -- certainly what happens in the secondary school.

We've tried to project some of these things. We've got an expidential (sic) model that says, "Well, what's this thing going to look like in the year 1995?" If I got out to 2000 and if we expidential model in terms of women entering the first year, students might go over fifty percent.

And some people may laugh at that, but I was talking to our industrial engineering department just yesterday and now in our industrial engineering program at Purdue, we have over forty percent of the students are women.

So there are some differences. But unless some action is taken, I'm afraid the situation is going to be more of a logarithmic kind of thing.

If one --

CHAIRMAN OAXACA: You dropped one down there.

DR. LEBOLD: Okay. (continuing) -- one were to look at that kind of thing, I think we could very well have this kind of a growth.

And it's, unless something is done at the pre-college and college level and at the graduate level, I'm afraid the logarithmic thing may be a reality.

CHAIRMAN OAXACA: Doctor, if I may ask, we have some members of the task force who are unsighted.

If you could maybe give some critical numbers, because a presentation of this type is probably difficult for them.

DR. LEBOLD: The numbers appear in my testimony and are given in detail numbers for all population groups are given.

But if you're talking about ballparkwise (sic), for example, we're now giving about a hundred thousand baccalaureate degrees in this country, it's about fifteen percent of them were awarded to women, about two or three percent to Blacks, about one or two percent to Hispanic and less than one half of one percent to American Indians.

What is of serious concern, to assess a ballpark --

DR. DANEK: That's engineering.

DR. LEBOLD: (continuing) -- depends on what year and it's include in my testimony in detail the exact numbers projected up to '86.

I do not have the '86 enrollments for 1986, for first year enrollments for all the other things that are included in there. If you want the numbers, they're there.

But Betty Vedder is the best and then she's one of your resources on numbers, because I get a lot of my data from Betty when I can't find it any other place.

(LAUGHTER)

DR. LEBOLD: I'm going to try and talk about something a little bit different. I think it's very important that we keep in mind the comprehensive programs that are most important.

That these quick fixes that have one little program or one little tiny emphasis are simply not enough.

We need to be worried about recruitment, what happens before college; we need to be worried about retention, what happens in college.

And by gosh, we'd better be worried about what happens after college, because students, especially engineering are very sensitive to what the job market is and while some people may decry that, it's the thing that really fuels the market and it's one of our major strengths and one of the things that can be a very positive thing.

I think we need, these are just examples of some things that we are doing or some of colleagues are doing at many other -- by comprehensive programs.

We have college search programs, summer programs, career programs, merit awards, pre-college kind of emphasis, we have retention, it's very critical you place students properly in beginning college -- we have many students, we use five to six years as the best time for him to look at, from the time -- and then of course after graduation.

Graduate school is critical, not only in science, but increasingly so in engineering. It looks like the younger -- over fifty percent will have at least a masters degree in the future.

These are very important. The kind of things that have to be done and I, as I mentioned, I think we need to worry also about the level.

We take pre-college, it's got to go all the way back to the elementary school. If we're talking about post-college, I just came from IEEE Career's Conference where the concern was about retired people.

There's a all, a total kind of picture that you must be able to look at at all levels, not just emphasizing a quick fix at a junior high school level.

I'll just give you an example on recruitment. Here's a comprehensive recruitment program and I'm trying to emphasize action oriented things, because I think that's what this committee is interested in by now.

If we're going to have an effective recruitment program, you need to bring in role models, we need to be sensitive to gender, ethnic and any special kinds of thing, like handicapped people or disabled people or what I'd like to call able people.

We need to provide them information on going to college, we need to give them information about engineering and if Purdue, we'll give them information about Purdue.

And many of the students who participate in our college programs do not go, necessarily to Purdue and they do not necessarily study engineering if they do come to Purdue.

If the goal is to help all of the students then this is very important. We need to have hands-on experience, be they computer or project oriented. We need to have counseling and so on.

And I think and I spend most of my time on evaluation and that has to be very important.

Now, I'm going to talk a little bit, somebody told of what I mean by the recruiting program.

I'm going to skip over the women's program because one of our, my colleagues will be talking about this a little bit later, Jane Daniels, but this is the typical recruitment program that we have at Purdue for minority students and I'm sorry this doesn't quite fit.

CHAIRMAN OAXACA: You have one minute, Doctor.

DR. LEBOLD: Okay. And this is

just an example. Some are seminars, the Preface Program is a week on campus, literature, we have a summer -- program. This is just an example of the kinds of things.

The last thing, but what I'm saying, I think, is you need a comprehensive program that both focuses on recruitment, retention, I think a comprehensive program also has to be involved in employment and graduate school, as well, and they all have to be evaluated.

The last thing I'd like to do is, since I saw it in your literature is to talk a little bit about salaries.

You know, we sometimes worship the almighty dollar and I think one of the things you should be sensitive to when you compare salary is, this data is based on the NSF, 1984 data, this engineer salary.

If you look at men's salary and women's salary, it looks like women's salary is about seventy-nine percent of the men's, however, that same report indicates that women, on the average, are much younger, they have about five and a half years experience, whereas, men have about fifteen and a half years.

So in order to make comparative studies and we've tried to do that from NSF data, compare it then, you see that at the beginning level, there really are very small differences in beginning salary.

When a difference is seen to begin to occur is in the mid-career area. And that seems from our research to indicate it's due to the supervisory responsibility that usually involves higher salaries and women are not as likely to begin that. Our data indicates they have the same level of technical responsibility.

So in closing, what I'd like to say is if we look at the whole picture, comprehensive programs are really what we need if we're going to become a effective program.

I'd like to commend the NSF for their new program on career excellence. You know, I served with that committee with Shirley for many years and we kept bargaining -- and Joe, I must commend NSF for really starting something with their new career access program that focuses on just what this task force is talking about, women, minorities and our abled handicapped disabled.

Thank you very much.

CHAIRMAN OAXACA: Thank you, Doctor. Surely, Purdue University is one of the fine engineering schools in the country and we surely thank you for your time.

I would ask the task force if they have any questions for Dr. Lebold.

Mr. Herb Fernandez?

MR. FERNANDEZ: In terms of your -- of special programs to influence lower grades, mid-school and elementary school, do you have any cooperative programs with the Department of Education of the United States might translate into the secondary schools directly on demo programs or some special program?

DR. LEBOLD: One of the things

that, one of the things I didn't include in the package is one we called Engineering for Minority Eight Graders and we did have a program and still have a program for minority students, where we work with eighth grade students.

But we've even gone back as far as the seventh grade. And one of the important strengths of that programs is a parent's program, so we have had some programs.

But we don't work directly with -- most of our support has come from industry, some government grants and some of the foundations.

The Sloan Foundation was one of the strong supporters of minority and engineering programs. We, however, and so one of the concerns we have now in recent, with the merger, is getting the industry support has become very, very difficult.

And our sources of outside support have been very limited. The University puts very significant resources into it too.

Yes Ma'am?

MS. FREEMAN: How do you identify the eighth graders who will enter the program?

DR. LEBOLD: What we've usually done is contacted the high school and usually it turns out that a math or science teacher, maybe a principal or counselor, we try and ask them to identify students that would have a potential for engineering, not necessarily to high flyers and that in science, but those that would have potential.

You know, lots of times, hands-on things, especially in engineering is very important, conceptual kinds of things. And we found that's an excellent way.

And what we did in Indiana, we just tried to stay in the center and all the corners of where the most of the minority population exists and we just worked with those school systems.

And we could have had programs, but we limit it to about fifty to a hundred students, but we could have had five hundred.

CHAIRMAN OAXACA: Dr. Scadden?

DR. LEBOLD: Yes, sir?

DR. SCADDEN: Yes. You talked quite a bit about what we should have in place and obviously you are inferring that or I'm inferring that Purdue has some of these recruitment programs in place, I'd like to know how they are staffed.

When you are working with a group of fifty to a hundred middle school children, is it during the school year or you indicated summer.

Who is staffing this? Is it Purdue staff? Is it industry people and if so, how do you get these people involved?

DR. LEBOLD: No. At Purdue, we have a Director of Engineering, we have a Director of Minority Programs and one of the people who will be testifying later is the Director of our Women's Program.

They have some support staff. They get money from industry that helps support some of the programs. We've gotten money from foundations.

In some cases, we've asked the

students to support the programs themselves and many of them are quite able to do that and so it's a combination of sources of support.

But we have, and in their support staff, clerical staff, graduate students, undergraduate students that we use also. And they may not necessarily be only engineering students, although we tend to lend toward engineering students in our program.

DR. SCADDEN: My question, specifically, is referring to, I gather then that some of the graduate students and undergraduate students then they work with the middle school students, they work as mentors or they, what exactly are they doing?

DR. LEBOLD: The primary program is try engineering for a week in the summer.

DR. SCADDEN: Okay.

DR. LEBOLD: That's what our focus has been. We've gone to one week programs because we can spread it out more.

The other type of program is to

have a smaller group spend the whole summer, but we felt that there's, for everyone we contact, our research indicates that about five or six other teachers are touched by it.

So if you can have a hundred students come in, that multiplier effect. And that seems to also work with the teachers and counselors; when they first start, they only talk to maybe a few minority students about it and by the end of maybe three or four years they've talked to hundreds in a given year.

Yes, sir?

MR. BIAGLOW: I've been to the University of Purdue many, many times, so I've had access to many of their buildings. Their parking is adequate for handicapped individuals, the ability to get around from one building to another.

There's another question though, because many of your buildings are old, many of your lecture halls are up on one floor or two floors -- steps. Many of your leisure facilities are in the basements of buildings where you have to go down steps, no elevators are available.

What is the University of Purdue and other universities doing about modernizing their facilities for handicapped individuals?

DR. LEBOLD: There are about three things. One, the oldest building on the campus is right next to my office and we have installed ramps in the Mechanical Engineering Building, that's an example.

Almost all the washrooms are accommodated to take care of it. I don't, I still think there's a problem though of the access.

I don't know when you were on the campus, when?

MR. BIAGLOW: About two years ago.

DR. LEBOLD: Yeah, but, and it is still is a problem. We do have automatic door openers, which still isn't an environment a lot of us think should be expanded as it should be.

And I think we're continuing working on it, the new building will have considerable access to it and we have done, it's significant, I think the university spent millions of dollars to provide better access, but we haven't done enough.

I must say that I would agree with what you're saying, a lot more has to be done.

CHAIRMAN OAXACA: Dr. Danek?

DR. DANEK: Yes. In your view, how many other engineering schools in the United States have competitive, have comprehensive engineering programs similar to the one that you talked about?

And if it's a small number, how do you explain that number and what would you suggest that this committee do to try to help encourage more schools to have those kinds of comprehensive programs?

DR. LEBOLD: Well, I think we can learn a lot from established institutions. I think we picked up a great deal of information on how to handle our minority programs from Black colleges.

I think, I think there are probable, I think, five years ago or ten years ago, there weren't very many, maybe twenty or twenty five, but were doing significants amounts.

But now everybody's getting in on the act and I think Jane could give you the, some figures on women's programs. She's done some very good research in regard to that.

But my guess is that at all the institutions there's a sensitivity now that wasn't there before, but as far as committing resources, I would guess about one-third have some significant resources.

In many cases, we've found that this is the job that's given to an Assistant Dean or Associate, very few have directors of programs like that.

The larger institutions are in a better position to do that, but there has to be a commitment from the top down in order to get it done. It just won't happen otherwise.

CHAIRMAN OAXACA: Dr. Joseph and

then the last one will be Ms. Garrett.

DR. LEBOLD: Yes, Dr. Joseph?

DR. JOSEPH: -- need to keep engineers in the pipeline through the ivy league school. We're aware of the Bachelor salaries that are high for engineers and the need for engineering pessimists at the same time.

Do you have interventions that you recommend as helpful in that critical area and could you comment on --

DR. LEBOLD: My two colleagues, Jane Daniels and Marian Bylar, received an affirmative action award within the university and part of the, for their program for women and minorities.

And they took some of their assets to develop a pilot program where we provided students, not only from our own institution, but from some of our sister institutions in this area, to come and participate on the opportunities for graduate school.

I believe that we feel at Purdue we

have to do a lot more work at the graduate level, and so what we're increasingly trying to do, even at the high school level, is start talking about, when we talk about role models to bring in academic people.

And we have some tremendous role models at Purdue, particularly with regard to women. I think our role models as far as minority engineers is still very much lacking.

And we're continuing to work with that.

MS. GUERRA: Is your school, with its fine reputation for its engineering programs doing anything to develop some re-entry programs where people can come back and retrain in new disciplines of engineering?

And I'm not talking about a long-term graduate program, but something that might be in a --

DR. LEBOLD: I believe that the re-entry programs have their primary strength when they're in urban areas where, because usually the women that want to participate are in those programs often have family kinds of responsibilities and the movement thing. We have, primarily at Purdue, pushed the graduate program.

One thing we haven't tapped, however, that we do at the graduate level is our television network that goes all over the state and we do offer graduate programs.

I don't think that's a resource we even looked into, but the potential is there because we're giving graduate, doctor level education now all over the state and we're cooperating with other institutions that are providing graduate education all over this country.

And the technology is there and I don't think the engineers are afraid of it, but I still think it's a matter of resources is the problem.

But re-entry programs is not, we felt, has not really been one of the things that we have any stake in doing because of our residential location. But with the new thing, we might --

CHAIRMAN OAXACA: One last thing, Doctor, it appears that, you know, this is our second public hearing.

And I guess I personally conclude that one of the forgotten elements of this task force, as we've talked to the people that have testified, is the real sensitivity to the fact that there's a lot of talent out there at all age levels that would fit into the handicapped category.

And it appears that there are no programs that are really tailored to doing the sorts of things that you put up there on your last chart for the handicapped --

DR. LEBOLD: Yes, you're right.

CHAIRMAN OAXACA: What do you folks suggest might be done by this task force to make sure we correct that?

DR. LEBOLD: Well, I think one thing NSF -- is in almost all of their announcement now for programs, educational programs as well as technical programs, which -- they do have special resources.

But I think sometimes getting role models in front of the public, maybe be a public television or something like that would be one of the ways to show the success and my colleague and I were talking back there, he's a physicist gone engineer.

And I think these people are really the way we have to do it. I think role models help, but that's not enough. We really have to get them on campus and hopefully so that they can be mobile and able to do it.

And then we have to follow through and find out what kind of the problems are. It's a very difficult situation, even though we have all these dropouts.

I think comprehensive, I go back to my bottom line, it's got to be comprehensive, not just provide some aids.

CHAIRMAN OAXACA: Thank you very

much for your testimony, Dr. Lebold.

DR. LEBOLD: Thank you, it's a pleasure being with you.

CHAIRMAN OAXACA: I would like to ask Ms. Christa Lane Larsen of the 3M Company, she's the Advance Research Coordinator and will be talking about technical women's programs for recruiting minorities and handicapped.

Welcome to our task force.

MS. LANE: Thank you, it's nice to be here. I'd like to thank the task force for the opportunity to speak about 3M's Visiting Technical Women Program and also Technical Minority Recruiting Programs.

The Visiting Technical Women Program at 3M was started in 1978 as an outgrowth of a National Science Foundation Program back then and it continues to be supported by all levels of management and it's also very well recognized by the community we serve.

The program is one of many which is organized under the Science Encouragement

Committee of 3M's technical forum. This is a group of six thousand technical employees there in the metropolitan Minneapolis and St. Paul area.

The Science Encouragement Committee has like six programs, six to eight programs underneath it which are focused mainly at students and encouraging them into the science areas.

And we also have a program where we bring in teachers from the school districts into 3M for six to eight weeks in the summer and they work in the technical field also.

Currently, there are over one hundred women participants in the Visiting Technical Women Program and we annually go to schools and visit them.

The program is represented by a variety of women, degreed women, non-degreed women, minorities and handicapped.

Our participants are employed in a wide variety of jobs. We have engineers of all specialties; industrial hygienists, toxicologists, audiologists, biologists, chemists, physicists, nurses, patent lawyers, technical librarians and women who have combined their technical education with a master in business administration and who have moved from the technical area into marketing and business-related fields.

So we're well represented by the entire company and the kinds of jobs that 3M has.

The objectives of the Visiting Technical Women Program are to provide young students with the opportunity to meet and interact with women who enjoy their technical careers and the associated benefits; to show students how science knowledge is applied everyday in industry and that one doesn't have to be a genius to have a successful technical career; to provide information about the education required for technical positions and to emphasize the importance of keeping options open by taking math and science course throughout all their education as they consider future careers.

Each school year, we visit forty to fifty elementary, junior high and senior high schools in Minneapolis-St. Paul metropolitan area.

We attend eight to ten career fairs or special programs at local colleges and vocational institutions.

We also receive requests for six to eight communities outside the metropolitan area that ask us to go to those schools also.

The visits are usually coordinated through a science or math teach or career counselor and they consist of presentations to generally math and science courses, math and science classes at the schools for a one-day visit.

We abide by the school wishes as to whether we talk to a co-ed class or to an all class, a class of all young women.

It's been our experience that when we talk to a co-ed class, the young men tend to dominate the questions and the girls do not ask questions of us. However, when we get young women by themselves, then more questions come out and so forth. That's an observation that we've seen through the years.

Some schools feel it's important for the young men to be there when we're there so that they can listen to us and interact with technical women role models and so that they understand that technical careers are appropriate for women as they are for men.

Usually two or three women visit a school during the day and we present very practical information to them.

We tell the students how we became interested in science and math, who encouraged us to pursue those interests, what our educational backgrounds are and the grades we attained during our formal years of education.

We demonstrate the products we work with and the research we conduct and then we discuss how our technical and communications skills are used everyday in order to solve problems in the work place.

We also talk about our careers and how we combine them with our family lives, because that's, we feel that's important for them to realize you can have a career and have a family life also.

We provide information for the students regarding the preparation needed before and during college for a technical career.

We not only stress the importance of taking math and science course, but we also stress the importance of English and Communication classes.

We tell the students that you may have the technical, an excellent technical idea, but if you can't communicate it to the people who need that information, then it isn't worth much. So we stress, not only math and science, but also English and communication.

We provide the students with current salary information for a variety of positions from fast-food hourly wages up to Ph.D. scientists and engineers.

However, we encourage the students to pursue their interests first and not necessarily the potential salary that a job may command.

And some of us even say the best job you can do for science or technology is be a science teacher or a good math teacher. Those people don't make a lot of money it's very important to those of us who are in science and math.

We emphasize the importance of obtaining good grades and also gaining practical work experience in one area of interest for pursuing a job.

We also provide students with information about financial aid and work-study programs that are available.

Additional information about other technical women and their careers is presented to the students in a videotape that our program has produced. It's called "Decisions" and we show this videotape and like I say it just provides more information to them.

We also allow significant time for

questions and answers.

The 3M Visiting Women Technical Women Program is extremely popular within the community. In fact, the demand is so great, we can't visit all the schools.

And annually, we ask the schools to evaluate our program. The responses have always been favorable and demonstrate that our program does have a positive impact on the students we reach, especially the young women.

Some teachers have noted that more girls are taking math and science courses because of our visit and they have noticed that increase in the schools.

Currently, there is an effort to expand this program. Right now, it's just located in, centralized in the St. Paul-Minneapolis area.

Currently, there's a program to expand this to our manufacturing sites around the country, of which there are approximately a hundred.

3M has manufacturing sites

typically in small, rural towns. We want to get the women that are in technical positions there involved in the program, so that we can reach even more students.

Right now, in the Twin Cities, we reach about five thousand students each year. When this program is fully implemented, then Visiting Technical Women will have that much more of an impact.

We have assisted three other companies in the Minneapolis-St. Paul area with developing similar programs of their own.

Those companies are Honeywell, Unysis and H. B. Fuller. Honeywell is the more developed of those programs and we basically split up. We take the St. Paul schools and they take most of the Minneapolis schools.

We have also written a "How-To Booklet," a guide to setting up a program, which is available to all organizations at no cost.

3M also has another program called Visiting Wizards, which is slightly different from

Visiting Technical Women. It's both men and women. They go out to the schools, generally the younger schools and take, two things; they can take a pryogentics experiment into the schools or they take a space experiment.

You know, 3M has been involved in space activities, so they take that into the school and demonstrate that science is fun and anybody can do it basically.

3M actively recruits women engineers and scientists and continually support student chapters of the Society For Women Engineers at colleges and universities -- recruits.

3M has an active Women's Advisory Committee and we also have an active Minority Advisory Committee that addresses concerns and issues associated with those populations.

3M is actively involved in recruiting minorities for technical positions and has implemented programs at the high schools, college and graduate levels of education. Those programs are listed here.

The STEP Program, which is the Science Training Encouragement Program, involves students from the inner-city high schools. The students spend one academic quarter in 3M facilities being taught chemistry and how it is used in conjunction with laboratory equipment and techniques within 3M. The students then spend the summer working the laboratory.

The intent of the STEP Program is to encourage high school students to enter post high school education in a technical field.

Twenty-five students participate in this program every year. 3M's MUST Program, Minority Undergraduate Summer Technical Program, was started in 1984 and this involves the recruitment and employment of students who are pursuing a technical program of study. Last year, forty students were hired into this program.

3M also encourages minority students to pursue graduate level work through the GEM Program, the Graduate Engineering Minority program and this program provides scholarships and jobs to qualified applicants.

3M also participates in INROADS, which is the national organization for encouraging minorities to enter professional careers.

3M has also several other work-study programs that are open to all students, but these are the ones that focus on minorities.

In summary, we feel that the Visiting Technical Women Program, which is nearly unique in American industry and business, has proved its worth at 3M. 3M continues to support us and it's also proved its worth to thousands of young women across the country.

We'll be marking our tenth anniversary next year and we just expect this program to continue and develop the way it has.

CHAIRMAN OAXACA: Thank you, Ms. Larsen.

One thing that I would ask of you, who are are also like myself in the private sector, what we want to prevent is to come up, is to have this task force come up with a report that historically a lot of reports are never read.

So we're very anxious to have this report be tied into things that will actually happen and so part of our thrust will be and we're in the very formative stages.

We would impose upon you to talk to your gun, numero uno --

(LAUGHTER)

CHAIRMAN OAXACA: (continuing) -- to get his thoughts perhaps and maybe get that into the task force on how, in your part of the country, representing a corporation that's going to have to compete just like the rest of us as a country.

What can we do to use the significant resources, advertising resources, the clout to go national with, this is a very critical national survival issue.

Once again, quoting Betty Vedder and understanding what happened to Senator Biden--

(LAUGHTER)

CHAIRMAN OAXACA: We are going to be kind of asking the same question of all the people in the private sector, because the Mobil Oil folks have come up with such a nice pattern of editorial type advertisement, issues of the dropout rate, issues of what is indeed an absolute requirement in the future for American industry to have a highly skilled pool of people to draw from.

And so, maybe as you go back and report to your folks, you know, see if maybe we can get some guidance from some of your very senior people into Sue, into the President of Scientific -- Dr. Bill Graham, we'd like that.

Any questions from the task force? Dr. Joseph.

DR. JOSEPH: I thought your program sounded exemplary. I'm curious about how well 3M is doing in -- then that women, minorities and the handicapped have opportunities for high level -- management positions in the 3M Company, whether they sort of practice what you're promoting in these other --

MS. LARSEN: I, of course, don't have any statistics on that, but women are moving up in the technical positions and into manager positions within 3M.

There really isn't a problem with women in technical positions within 3M. Getting them into the company and promoting them.

MS. BRASEL: How about minorities?

MS. LARSEN: Minorities are, 3M is working on that, as every company is. And that's the best thing I can say. And the handicapped also, we're working on that.

CHAIRMAN OAXACA: Ms. Freeman?

MS. FREEMAN: Do you have an evaluation component to your program?

MS. LARSEN: Yes.

MS. FREEMAN: Do you know what happens to these young people?

MS. LARSEN: No, we really don't. We don't look at exactly what happens to the students, but we do go to the schools and ask the schools what they have felt our program needs for the next year and so forth.

But we don't have any mechanism right now to exactly track the students that we have talked to.

MS. FREEMAN: What about the summer program or any program that you have to have hands-on with the students?

MS. LARSEN: There is a possibility in that those programs are, you know, come under our human resources group and I am not in that group, so I can't answer that question directly, but they may very well keep track of those students.

MS. FREEMAN: Could we find that out?

MS. LARSEN: Yes. That's a good question, I'll --

CHAIRMAN OAXACA: Dr. Scadden.

DR. SCADDEN: You indicated that you have a "How-To Book" that's been used to, with other companies.

Would you be able to make that

available, at least one copy, to our --

MS. LARSEN: Certainly.

CHAIRMAN OAXACA: How about the videotape?

MS. LARSEN: The video, we can also provide you.

MS. BERMAN: How long is it?

MS. LARSEN: The video is about twelve minutes long, that's about all. Any student can look at a videotape or any adult for that matter.

CHAIRMAN OAXACA: Dr. Jeffers?

DR. JEFFERS: The question that I'd like to pose to you concerns the fact that, it's my understanding that you go into these schools for a one-hour or a one-day event.

It's also a question that I intended to ask Dr. -- but did not have an opportunity to in terms of statistical information.

But in terms of your impression, the day-to-day instructors in those programs who interact with the students five days a week and -- a year, what kind of sense do you have of how they relate to promoting, encouraging, assisting minorities and women and disabled in pursuing this academic interest?

Because that, to me, is critically important, not just a one-shot deal and that's not to diminish the importance of what you do, but it's trying to get a sense of how you perceive the day-to-day attitude expressed by the instructors.

MS. LARSEN: Well, personally I feel it's an education to go to a school for a day when you've been in industry for a while.

And my impression in the schools that I have been in, in the five years that I've been associated with this program, it's amazing to me, first of all, the lack of discipline.

I mean, the teachers stay there with us in the school, but it's almost a fight to get their attention for the small time that we have and you know a class is forty-five minutes long or fifty minutes long.

And two or three women speaking, you know, it's like anything else, you're trying to cover a lot information. And we make the teachers stay there and listen to us.

That's our support for being there. We don't want them to leave, we're not in charge of the class, but I'm amazed at, either I was a "Goody Two Shoes" when I went through school or things were a lot stricter.

Because what I've seen in school, in the science and math classes where we talk is just not up to my standards of education in the public schools.

So I, you know, that could be part of it.

CHAIRMAN OAXACA: Thank you so much, Ms. Christa.

MS. LARSEN: Thank you.

CHAIRMAN OAXACA: Oh, one short one, Dr. Berman?

DR. BERMAN: I just wonder what kind of support you get, along your lines, from your senior management.

Is this grass roots or is this something --

MS. LARSEN: For this program?

DR. BERMAN: Yeah.

MS. LARSEN: Visiting Technical Women is supported through the technical forum which is supported by management and it is well supported by management.

DR. BERMAN: Do you do this as extracurricular or is it something that --

MS. LARSEN: No, it's not, we, it's not really extracurricular, we go out on company time to do the visits and the work that needs to be done on the program by those of us who are on the committee on, is done on company time.

DR. BERMAN: But it's up to the women to sustain it though, right?

MS. LARSEN: Yes. We do have a budget though too that we do get money for doing what we need to do.

MR. SCURRY: Mr. Chairman, your

indulgence?

CHAIRMAN OAXACA: Yes.

MR. SCURRY: I've got a blind spot back here.

Ms. Lane-Larsen, one of the concerns I have is that we hear the term qualified used most often when we make references to women and minorities.

And it is oftentimes a very elusive thing in terms, in terms of their application --

(LAUGHTER)

MR. SCURRY: (continuing) -- oftentimes a method factor to ease one out as opposed to a positive factor to ease one in.

You used that term in regard to your GEM program for scholarships.

What does it mean at 3M when you say, those who are qualified you give them scholarships.

MS. LARSEN: I think, that's, you know, my editorial comment word in there and I'm sure at 3M anybody is qualified, regardless of race, sex, you know, religion, whatever it is.

You have to be qualified, you have to, whatever it is, the grades you have to attain, the experience you have to have, whatever it might be, everybody has to be qualified for that position.

MS. FREEMAN: What are the quantitative of criteria that would serve a definition for qualified?

MS. LARSEN: I can't answer that question. I don't know. I don't have that --

CHAIRMAN OAXACA: It's like at Northrop, you have to have a certain grade point average, you have to, it has to fit the criteria for a career that's, I mean a degree that's going to go all the way.

Or it's a shotgun approach to taking different courses that are germane to some assignment that you have.

They're not going to pay your way to go to Chiropractor School when you're working on, you know, artificial intelligence and that sort of thing.

You know, that doesn't fit into the, and they also have, they also have, you know, I'm sure 3M is like most industries, you have a hundred percent educational refunding.

And including in the graduate program, you're allowed time off to study for your finals, to do your thesis, that sort of thing.

So I think industry is recognizing that they've got a problem in the future and they should encourage that.

Now this who's qualified is a big issue.

MR. SCURRY: I think so. One of the things that, one of the terms that we use too often at my agency and I've been trying to get us to rethink it, is the brightest and the best.

I'm not so sure that you need that you need to be that bright and I'm not so sure that a step below the best is not also adequate to provide the kind of services that we need provided in the science and technology area.

And that we begin to steer or eliminate youngsters, if you don't have an all "A" then we cannot -- put you in an academic curriculum and then when you get to high school, if you don't have a 3 point, then you can't look to get a scholarship to major in science and engineering.

And after you graduate, if you don't have a three sits (sic), you need not apply EPA, if you want a Honda of a job.

And I begin to wonder if that might not be something we want to look at.

CHAIRMAN OAXACA: Thank you so much.

MS. LARSEN: Thank you. I'd like to ask Dr. Ted Ansbacher from the Museum of Science and Industry and he'll we testifying on women and minorities in Science Museums Programs.

Welcome to the task force.

DR. ANSBACHER: I don't know if you have representatives from other museums who will be speaking to you at other sites. I broadly think of myself as representing perhaps the entire range of informal education, more specifically museums and science museums.

Certainly when one looks at the basic problem of women, minorities and the handicapped in science and technology as has been -- from previous speakers already, education is the primary area in which one would look as the development of skills, knowledge and attitudes.

And the term, education first of all brings to people's minds school. But increasingly, recently recognition has been given to the importance of other school, informal education experiences.

Television can be included in that, perhaps magazines are included in that, but I'm thinking particularly of course that museums are included in this informal educational experience.

The question is what is that and what is its role in perhaps encouraging more women and minorities and handicapped to enter into science and technology.

Museums, the primary characteristic, as I guess everybody would notice that we have exhibits. And exhibits mean that we have either historical objects or in the case of science, museum's largely constructed devices and then interpretive things, were it audio-visual and so on, with the intent of making some particular subject area accessible to a broad public.

Now, as places to learn as contrasted primarily say to schools and formal education, museums have two primary characteristics.

One is that we are informal educational institutions, which simply literally means that people come there of their own free will and we do not test them on what they've learn, nor grant credentials on the basis of how long they've spent there.

What the museum can do along this line, we can stimulate curiosity and we can provide a rich environment that the individual can then investigate to follow up that curiosity.

But the learning, such as may occur, must be from the initiative, the inquiry of the visitor, him or herself. And it occurs in a quite spontaneous manner.

Now this characterizes the informality or the informal part of the learning. Now I think it has to go without saying that if this experience were not also enjoyable, people would not come to the museum, again, it's a pretty well kind of thing, so we have to have enjoyable experiences.

Now the enjoyment should hopefully be this deep satisfaction of understanding and learning and not a superficial entertainment that we put on -- things, but I think in many cases it really is there.

A second characteristic of museum learning is that it is based on what is experienced. The primary purpose of an exhibit is to see and to do something, not to convey a lot of factual information and words.

In other words, the visitor has an experience. And so that the kinds of learning that might come out of a museum visit or museum experience are not necessarily the same kinds that you expect to come out of a school, which for better or for worse we think of as more information, factual, verbalizable (sic) kinds of knowledge.

The kinds of learning that may take place in the museum are perhaps of a more intuitive, gut level type which we give the name to physical knowledge. You've done it, you know it in your gut, which can be very important in science and technology, which is were the development of concepts and so on really takes place.

And also, things that can happen at museums are a little bit more subtle, but changes of attitudes -- what you think about things and how you feel about things.

And some of the deepest learning that takes place through museums is this may not be apparent until many years later and so all of these things make it a little bit more difficult to evaluate and compare, perhaps, to formal education.

We look now at what part of the education problem museums can best address in providing better education for women and minorities and the handicapped, the first thing I try to think about is, well does better education for women, minorities and the handicapped differ from better education for all?

And the first answer was, not very much. I think if we really had better education for all, lots of the problems we're dealing with would be, would be swept away with it.

But there are some parts of the problem I think can be very specifically addressed through the particular strength of museums and science centers.

One of these is early exposure to science in a very positive way. Jon Miller referred to the need to make decisions early and he was talking about seventh and eighth grades.

But I'm talking about elementary schools and even pre-schools, where a lot of attitudes are formed, where the beginnings of what I call physical knowledge are developing.

Our museum here in Chicago, the Museum of Science and Industry, has a special pre-school exhibit. It's extremely popular and well attended. Many museums throughout the country have similar exhibits and we know that they are having some effect in that way.

A second way in which museums can be effective, again, let me say the early exposure is not particular to women or minorities; that's necessary for everybody.

But the second way would be encouragement. Encouragement is a very subtle factor that I think is altogether too much overlooked in education, but it really is the key to all learning and development.

You may start with some curiosity, without some encouragement, you're not going to go any farther with it.

Encouragement comes about basically because I think of an attitude of respect for an individual on the part of other people encountered and also because of a satisfying and successful experiences.

A museum, to interact as exhibits and this whole informal approach they talked about, can give a lot of reinforcement to the individual and be very encouraging.

And I think we can also, through the way we approach our children's programs and exhibits, show adults how to really respect the ways in which children are learning and what they're capable of learning, which very frequently is absent with very young children.

The third thing, where museums can play a particular role and this is the one that does, I guess, specifically address women, minorities and the handicapped is exposure to role models.

Within exhibits, we try to show,

not only the principals and the underlying technology in science and so on, but also the people who are involved with that particular topic.

And what I'll talk about just a minute, we also have developed some specific exhibits dealing with women and dealing with Blacks and that focus primarily on this question of providing effective role models.

Before going on to those specific exhibits that the Museum of Science and Industry has developed, let me just add another footnote here. Museum education, good as I believe it is, is certainly most effective when it is combined with other elements of the educational system.

The museum's strength is in sparking curiosity, perhaps changing attitudes, etcetera, but it is by no means a complete education in itself.

And so one of the things which I think we need to look at more than we have from the museum's point of view is cooperating with other parts of the educational system.

Just a few facts about the Museum of Science and Industry and the broad, diverse audience which we reach, about four million people each year, of which roughly half our adults have children under the age of twelve, roughly half male and half female, so that we are reaching, you know, this broad, broad audience, particularly in terms of the women.

We don't have data on the racial minorities attending the museum, but we guess it would be approximately thirty percent racial minorities attending the museum.

We have free general admission, so that ensures access to all economic levels as well.

Two exhibits which we have developed, have developed as traveling exhibits, so they've gone all around the country.

One deals with women in science, the other one which is currently under development deals with Blacks in science.

Just briefly, the women in science exhibit was titled "My Daughter, The Scientist." It contains descriptions of many women currently scientists and engineers and descriptions of their work and their careers, etcetera; as role models, that also contains artifacts in interactive gains and devices to try to talk about some of the problems, particular problems and obstacles that women might encounter in pursuing careers.

And it also reviewed historical and contemporary, historical women that have contributed much to science.

It travelled for two years throughout the country; it is currently at its last site in the Museum of Science in Boston right now and then will be returning to Chicago.

That exhibit was funded through the museums themselves through what is called the Science Museum Exhibit Collaborative, but two -- pieces they were produced in connection with and were funded by the National Science Foundation and these will be attached to the remarks that I leave with the Committee.

The exhibit which we're now developing is called "Black Achievers in Science." It has a very similar format to the "Women in Science" exhibit; that it will highlight Blacks who've had significant achievement in science.

It will focus more on career aspects perhaps than the women's exhibit did, giving particular charts showing past careers in various disciplines and that exhibit will open here in February and then travel through, three years throughout the country.

It is funded by Citicorp Corporation, funding for that exhibit.

And the last thing I would say just very briefly, that we've done also in connection with the Women in Science exhibit was to do workshops for teachers.

One of the publications, there were two in connection with that exhibit. One deals specifically with how teachers in their classrooms can do things so it will be more encouraging for women. It points out some of the attitudes that might be present that they might not be aware of and some of the activities that they may do.

We felt this was appropriate for science museums, to try to incorporate some of this more hands-on learning in the classroom -- as I said experience-based learning for which science museums are best known.

So we, we were very good institutions for which to try to infuse that into the classroom.

CHAIRMAN OAXACA: Thank you so much, Dr. Ansbacher.

Questions from the task force?

MR. BIAGLOW: I'm going to speak up for the handicapped again -- women, certainly must include a program for handicapped scientist, unless you have individuals like Steinmetz as role models-- work in a hunchback.

I think it's a classic example of an individual with a handicap who ruled the field for years. Edison invented the light bulb, but it was Steinmetz that made it hot.

So I suggest --

DR. ANSBACHER: Well, I, all I can say, I admit to our fault there. We have done nothing specifically to highlight handicapped as role models, because I think we could.

We have had some special exhibit, we're not continuing that. We did it for three years as an annual exhibit on the use of computers for, particularly for handicapped assistance.

CHAIRMAN OAXACA: Dr. Rios?

DR. RIOS: Dr. Ansbacher, two of the activities I really didn't hear about have to do with the hands-on aspect of the science -- exhibits for the young children and the other is special programs or intervention types of programs.

For example, in New Mexico, we have at the International Space Hall of Fame something called a space camp, which is an actual program that is very inspirational for young children in terms of science and technology because of the integration of computers and space technologies.

Can you comment on what you, the museum here in Chicago is doing in this area?

DR. ANSBACHER: Yes, we do a great deal in that and I couldn't cover everything in my remarks, but what I wanted to emphasize is, is two characteristics, informal and experienced based.

And then that infuses all, what we hope are exhibits and programs. We have classes for pre-schoolers up to junior high school.

We have summer camps also, including a day camp, a science club for junior and senior high school students; many opportunities that allow a more in-depth, intensive experience in, within the structure there for the individual interaction and so on.

And all "focus" on this "hands-on" type of learning.

DR. RIOS: Are these funded through the regular budgets of the museum?

DR. ANSBACHER: Yes, they are mostly funded through, there are fees attached to these programs and we hope they pay for themselves and they almost do.

And with the summer camp programs, we have scholarship support which we raise from various industry or private contributors.

DR. RIOS: In the summer programs, summer camps, how much of an impact do you have? How many students do you reach?

DR. ANSBACHER: Total students enrolling in all of our education programs is about four thousand for each year now.

CHAIRMAN OAXACA: Any other questions?

(NO RESPONSE)

CHAIRMAN OAXACA: Thank you so much. We'll take a ten-minute break.

(BREAK)

CHAIRMAN OAXACA: Let's reconvene. Now I want to welcome Dr. Elaine Copeland, the Associate Dean of Graduate College and Dr. William D. Trent, Assistant Professor, Educational Political Studies, College of Education.

They're both from the, I guess they're from the University of Illinois in Urbana? Both of you?

Welcome to our task force and we're looking forward to your testimony.

DR. COPELAND: Thank you. We are really pleased to have been provided to really speak to research that we recently completed, funded by the Southern Education Foundation on the effectiveness of state financial aid and the production of Black doctoral recipients.

We might add that our findings, however, would be findings that could be applicable to other underrepresented minority groups in graduate education.

Our research examines the effect, the efforts of five states, centered on increasing the production of Black doctoral recipients and these five states were Arkansas, Florida, George, Oklahoma and Virginia.

And we looked at these states because these were states that initially had their plans approved in terms of dismantling dual systems in higher education.

We report results from secondary analysis of state and national data, as well as results from interviewing individuals in Ph.D. degree granting institutions at those, in those states for the years between 1975-76 through 1983-84.

It should not be a surprise to many of us who are involved in graduate education, but our results show that there was little change in the number of doctorates granted to Blacks during that period.

First time graduate enrollment increased slightly, but tended to fluctuate from year to year.

The results suggests that new funding arrangements, implemented in each of the states, have mainly served to support students were already going on for the doctorate, but did not increase the pool.

I think we should be really

concerned if we examine data from 1972 to 1984 in terms of students, Black students who are enrolled in Ph.D. programs.

For example, if we look at full-time graduate student enrollment for the year 1972, we find that roughly twenty-one thousand (21,000) students were enrolled full time and this represented 5.3 percent of the total.

If we look at the year 1984, we find that this had declined to only eighteen thousand (18,000) full-time Black students for a percentage of 3.9.

I think this is really alarming, given that we are continuing to devise methods to increase the pool, but it seems not to be happening for these states or at the national level.

Professor Trent will talk about some of our recommendations and will provide more comprehensive reports on some of our data analyses.

MR. TRENT: Thank you very much.

And let me repeat my thanks to the Committee for this invitation to present some of our results to you.

I'd like to reiterate some of the trend issues, many of which you've already heard. We have included tables from earlier studies that we've compiled and just to sort of nail home the point of trends, I'd like to indicate that for the period, the five-year period, 1975-76 to 1980-81, when you look at minority males in relation to majority males and for all females, if we look at the fields of engineering and biological sciences, in 1975-76 in engineering, women received fewer than three tenths, no more that four tenths of all of their degrees at the Bachelor degree level in engineering.

By 1980-81, they had improved substantially to the point of receiving as many as 1.6 percent of their degrees in engineering for White females, 1% for Black females, 1.2% for Hispanic females.

So even though during that period

you saw substantial increases, the disparities are incredibly substantial.

Just by contrast, White males received 13.4% of all their degrees in engineering. Biological sciences, there are similar disparities, but not quite as great.

Minority males received approximately, Black males received about 4% of their degrees in the biological sciences in 1980-81, compared to slightly over 5% for White males.

Females, however, received no more than 4% of their degrees in biological sciences for any of the female subgroups, White females, Black females or Hispanic females; similar patterns obtained at both the masters and doctoral degree level.

The other point I would like to make in terms of looking at trends, if we're going to have an impact on improving the representation of minorities, especially Blacks in these fields, it's important to note where it is, what set of institutions primarily deliver degrees in particular fields.

In 1980-81, Black males received 42% of their degrees in the biological sciences from historically Black institutions, (34%) of their degrees in computer sciences from historically Black institutions, 36% of their degrees in engineering from historically Black institutions, 53% of their degrees in mathematics and 40% of their degrees in the physical sciences.

Similar distributions obtained for Black females. So, the simple point there is that if we want to have an impact on improving the supply and the quality of the experiences that Black students, in particular are having in higher education in the sciences, it is important to look at where the students, in fact, are and considerable attention can be given to that set of institutions with regard to funding, program enhancement and so forth.

Specifically, our recommendations regarding graduate training. We need to improve both the quality and quantity of aid. Quantity of aid, we mean we find that most Blacks receive the doctorate at an average age of about thirty-eight, compared to the White cohort age of about thirty-three.

By that time, Blacks have accrued substantially different obligations, responsibilities of a financial sort, so that aid needs to be of a sort which would be able to cover many of the additional expenses.

The average program, the average size of awards we saw were in the range of about five thousand dollars ($5,000.00) plus tuition.

Now, those, that amount, in many instances, simply is just not sufficient.

The quality of aid has to be of a sort to be retentive. Many of the programs that are addressed in our study are not retentive in the sense that students do not know that they have the money for a designated period of time; four years at a minimum.

Similarly, at the undergraduate

level, program monies should be retentive in the sense of students receiving the aid and having that aid committed to them for a designated period of time, oftentimes to exceed four years because many of our undergraduate students are taking more than four years to complete the degree.

For students who have talent, but who have had insufficient time to demonstrate that they have that talent, it may indeed take more than a standard four-year period to provide them the opportunity to demonstrate their quality.

DR. COPELAND: I would like to maybe just bring home the point that programs such as a Patricia Roberts-Harris Program, funded through the Department of Education, should be supported and funded at a level that is adequate to support students.

I can note, for example, that our first Black Ph.D. in metallurgy in the history of the University of Illinois graduated last year on the Patricia Roberts-Harris Program.

If we look at the survey or earned

doctorates in 1985, we find that Blacks were least likely than any other group to be supported through TA or RAs and this was across fields.

And even when we compared the sciences that tended to be true, so that while we're saying that we have an older population that is returning to school, they were most likely to rely on their own personal and family earnings than through institutional support.

MR. TRENT: Another aspect of improving the aid, particularly at the graduate level, should be the use of mechanisms to supplement tuition and other kinds of fellowship awards in the following ways.

As the gentleman from the museum suggested, exposure is incredibly important. The kinds of aid that minority students and women often get, does not fully introduce them into the mentoring process, which exposes them to the various forms of research, etcetera.

So, the University of Oklahoma has an interesting program where they reward institutions that are providing additional mentoring experiences for the students.

Very quickly, we feel that the aid should be targeted to support students in specific graduate programs, i.e., in the sciences to compete with highly attractive employment opportunities, particularly in engineering.

We could consider extending aid at the graduate level to part-time students. Many of the students who are employed, some of our largest pool of Black and other minority persons with Bachelor degrees are in the labor market and in urban areas where there are outstanding institutions with science programs and technical programs; that certainly could be an attractive feature.

Recruitment and retention. Emphasis again has to be placed on pool expansion. We have pipeline problem, which has been identified in several different instances.

For the past ten years, Black enrollment at the undergraduate level has declined by some fifty-five thousand (55,000) students. Forty-four thousand (44,000) of those students are Black males.

We have a pipeline problem that does not work the same way for all sets of minority students and it's important that our pool expansion efforts be directed in a more precise way.

But it can indeed be done through funded programs for recruitment. Many of the colleges and universities we looked at were not funded to do recruitment, that is not a funded activity. It has to be funded if it's going to be managed well and if it's going to be effective and it has to be directed at places where minority students are.

DR. COPELAND: I'd like to mention a program that we just instituted for the last two years in terms of expanding the pool at the CIC institutions, the Big Ten universities and the University of Chicago.

And we currently are funding a

Summer Research Opportunities Program across all disciplines for underrepresented minority students who do have three, 2.75 grade point averages and above are eligible at the end of their sophomore and junior year.

Through institutional funding and funding for the Lilly Endowment and the Mellon and Kellogg Foundations, this past summer we supported two hundred and thirty-one (231) students throughout the CIC.

Now that may seem a small number, but we believe currently we're the largest cooperative effort in this regard trying to expand the pool.

This program is focused on underrepresented minorities, Black, Hispanics, American Indian. And we, it's too early to tell whether this program is accessible, but we do know that students are having positive experiences.

CHAIRMAN OAXACA: Thank you. Thank you very much. We'd like to ask questions.

Dr. Scadden, please?

DR. SCADDEN: Yes, Dr. Trent, I'd like, if you would please amplify briefly the Oklahoma Mentoring Program, something about operations, staffing and funding.

MR. TRENT: The way the program operates, I have it here, the universities are encouraged to develop ways in graduate students in their particular various departments would be able to participate in conference through the leadership of a faculty member, be involved in on-going research programs, have an opportunity to involve themselves in workshops.

That is, to have more involvement in the on-going careers of the senior faculty in those institutions.

When institutions report having done so, they then, through the state office, provide an additional incentive grant of one thousand ($1,000) to fifteen hundred dollars ($1,500) that the institution can then use to further encourage that kind of activity for the involvement of graduate students in their respective fields.

That --

DR. SCADDEN: Is that geared towards minority students, sir?

MR. TRENT: Yes, it is.

DR. SCADDEN: Fine, thank you.

CHAIRMAN OAXACA: Any more questions?

MR. SCURRY: Professor Trent, Dr. Copeland, you indicated and I think it's a fair assessment that most of the graduates, especially Blacks who get degrees in science and technology come from historically Black colleges and universities.

Does your research in any way provide data on whether or not the majority, and also most of the one hundred plus schools in the HBC network do not offer advanced degrees.

Does the research in any way suggest that the majority of institutions where in the main, most do offer advanced degrees are going to the HBCUs and recruiting students for that purpose?

MR. TRENT: Very good question. We found one institution out of the five states that had a well-developed program for specifically recruiting at HBCs.

When I say well-developed, I should say that all of the institutions in some way do that, but the University of Florida? I'm not sure which, but either Florida State or the University of Florida and I should be clear on it.

But they have a program which takes faculty members who will volunteer and a graduate student who is a minority student, sometimes not a minority student and this is any faculty member, not necessarily a minority faculty member.

They plan a recruitment schedule for that minority faculty member, generally lasting at least three days, develop a packet of materials, arrange all of the trip, all of the itinerary, send that faculty member off to visit some set of historically Black schools, both inside the State of Florida and outside.

And in doing so, they have gotten a high degree of cooperation and commitment from their faculty and the students who are recruited have a different sense of being desired by those institutions.

CHAIRMAN OAXACA: Dr. Malcom.

DR. MALCOM: I was going to ask about the whole set of environmental issues, because you, while you talk about the Florida experience, it is also true that there are other kinds of aspects of aid and graduate-targeted programs that are not necessarily under the State's rubery (sic) --

MR. TRENT: Yes.

DR. MALCOM: (continuing) -- that supports a whole base of effort in this regard.

MR. TRENT: In addition to the sixty plus grants that are funded by the State of Florida, there is also a McKnight Program, that's a foundation-based program and through the McKnight efforts, there are new involvements on the part of private industry to support additional numbers of students.

So, yes, there are additional sources of support there.

DR. COPELAND: I was going to also mention that the State of Georgia does identify students at, students from historically Black institutions with certain grade point averages and communicates with them.

I could not tell from the description of the program how much followup was done in that regard and I think it, recruiting has to be sometimes a very personal endeavor, rather than writing or just sending the student information.

But I could not tell from the interviews whether it was really, the followup was the kind of followup that would encourage students to go there.

CHAIRMAN OAXACA: Dr. Danek?

DR. DANEK: Yes. Is there any thoughts about expanding this study that you did from five states into another set of states?

DR. COPELAND: Well, it's interesting, because as soon as we, our report was released last year, a faculty member in one of the sciences at the University of Illinois called me and said how are we doing. And I said not much better, I don't think.

We would like to look at CIC institutions, for example, mainly because that group of institutions is the largest consortium of Ph.D. producers in the country.

I would think that we are not doing much better. We are at least now targeting our many efforts, but I, and so we do plan to expand into other areas.

CHAIRMAN OAXACA: Thank you so much. I'm sorry.

DR. JENKINS: As exemplary as the mentoring program at the University Oklahoma, as well as the other programs you mentioned at CIC--

REPORTER: Speak up, please?

DR. JENKINS: As exemplary as the examples are that you have mentioned, I have this terrible feeling they're just a drop in the bucket.

We don't have a handle yet on what ought to be done --

DR. COPELAND: That's right.

DR. JENKINS: (continuing) -- at the institutions of higher education.

Do you have a planned program, a series of recommendations you'd make to us that we ought to consider?

DR. COPELAND: Well, we do have some recommendations. They're not all inclusive.

I think as was mentioned earlier in some of the other testimony that we're going to have to really start at a much lower level.

Our program, our college program, summer program is one effort, but we find that many students don't ever get into four-year institutions.

We need to do much at the community college level. We need to do much in the high schools to get young minority students concerned about going on and I think it has to be comprehensive in nature and we're just mentioning a few efforts.

MR. TRENT: Just one point and I don't want to at all demean the issue of role models.

I think it is important and I would encourage the Committee say, modeling is extremely important, but being able to do things structurally that support and expand realistic opportunities, real opportunities for people and demonstrating to young children that there are real opportunities by virtue of building real programs and putting real money into efforts --

(LAUGHTER)

MR. TRENT: (continuing) -- has to be at least as important as being able to see people like yourself having an opportunity to move through or having moved through.

I think you need at least both and I'm inclined to think that the structural determinants are really important.

CHAIRMAN OAXACA: On that note, let us thank both of you, Dr. Copeland, Professor Trent. Thank you so much.

It continues to point up the monumental task that we have as a nation.

MR. TRENT: Thank you.

CHAIRMAN OAXACA: It's very disheartening to see that after all the horsepower that's been thrown into it, it's dropped a tenth of a percent.

I would like to ask Dr. Robert Springer, who is the Director of the Division of Education Programs of the Argonne National Laboratories to please join us.

Welcome to the task force testimony hearings.

DR. SRPINGER: Thank you. I'm going to speak to you on two topics. One is a National Department of Energy Program that is designed to increase the number of talented students that go in, go on to to graduate school and then pursue careers in research and development and naturally, the emphasis that that program places on the groups that you're interested in.

I'm going to, the Argonne component of that program is the largest one in the country and of course the one I know the most about, so I'm going to give you some detailed information about that.

And again, with emphasis on the groups that you're interested in and then indicate how that's magnified by the national program.

I'll also give you some information on how successful it is in accomplishing what it sets out to do.

And then the second topic is to give you some information about some employment figures, about women and minorities and handicapped at Argonne National Laboratory and some indication of the kinds of programs that are in place and being planned for, or being developed to increase those numbers.

These are the primary elements of

the Argonne Program that is designed for college and university faculty and students.

You see, the elements consist of a Sabbatical Leave Program, faculty research participation that is common participate in the research programs during the summer; program for students, graduate students to pursue thesis work, undergraduate students.

This is now something I want to differentiate between a student program that has an educational purpose and a summer job. We do have a summer job program, temporary employment.

This is different from the educational program where the students work with one-to-one with a, one of the scientific staff as a mentor for the summer or for part of the academic year.

The figures there show you what the total participation is that's typical for a particular year; the figures there happen to be for fiscal year 1987 and also the percent of the minority and female participation in those programs. We do not have, we don't keep data on handicapped participation in this program.

The figures for the faculty and graduate student programs, I'm sure are of interest, but as much as anything they reflect the problem that we're both interested in.

I'd like to focus some attention on the one that does the most to contribute to a solution to the problem, to increase the number of people in this field and that's the undergraduate program where you can see that the percentage of participants from the minority and women categories are at least as high and some of the, in one case it's higher than the representation of these groups in undergraduate programs around the country.

So there is a clear tendency to concentrate these students in these programs. And then the next most important facet of it is that these programs, I'll show you some data in a minute are successful at strongly influencing the participants to go to graduate school and then pursue careers in science and engineering.

There is also underway a major expansion of this program, particularly the undergraduate program. Most of these students are at the laboratory during the summer.

The new program is trying to expand programs that we carry on during the academic year in a sense of trying to make these programs an integral part of science and engineering curricula around the country in the same sense that off-campus programs, semester abroad programs and such are in non-science areas.

That is, they would come to the laboratory for a research experience and in addition take supplementary academic activities and receive a full semester's credit, not have their graduation delayed or anything of that kind. That's the emphasis there, that's underway just beginning this fall.

There is also, among the other elements in the program a set of workshops, conferences, short courses and the like for faculty and graduate students, particularly well over a thousand people come to the lab each year for that.

The aspect of that that's particularly important to you is a new annual workshop that we have started entitled "Science Careers in Search of Women."

We did that for the first time last year and this is a program that is organized by the women scientists at the laboratory and the speakers and so forth are successful women scientists.

We had about four hundred people apply to come to that this last spring. We could accommodate about a hundred and seventy. We will repeat that on an annual basis and will recommend that the other laboratory in the system do the same thing.

Now I mentioned that this is the largest of a national program. Similar activities, most of them smaller in scale and somewhat less diverse are carried on at lots of other laboratories around the country.

A total of about thirty laboratories are involved and the total number of participants, just to give you some broad feeling for the scope of the whole thing is about three times what it is at Argonne.

And the significance now, again, we do systematically do followup studies on what the effect of this program is on the participants.

We're in the middle of a major one right now that looks at the students that participated in it between 1979 and 1982. And what we have found is that eighty to ninety percent of the students that participate in this eventually end up with graduate degrees.

And that when they look back on this experience, more than sixty percent of them indicate that participation in this program was a strong influence in their decisions to do that.

And then also to pursue their careers in R&D, so as far as the purpose of this program, the data seems to indicate that it is highly successful and of course I think that's quite significant when you again consider the higher than normal percentage of minorities and women that are involved.

The laboratory also has a number of special institutional cooperations in place. Some of these are formal, some of them are not quite so formal; two of the five that exist at the moment are with, as you can see, minority institutions, one with Atlanta University and one with Chicago State.

Also I mentioned the new program that's underway to, the academic year program to expand and enhance that. As I said, we want that to become part of science curricula around the country.

In order to do that, the universities must participate and we are in the process of getting at least fifteen of the historically Black colleges involved in that program.

Those programs, again, were for

college and university faculty and students. This is similar information for the Argonne activities at the pre-college level and you can see that the statistics, of course, are similar and the percentage, the involvement of females and minorities in this are substantially higher than they are in the college-university programs.

And none of that is by chance. That's by design. There's a conscious effort to do that.

Again, the student programs are similar, some of them are similar in the sense that students will work with a mentor, some of them are structured classrooms. It depends on the level of student we're dealing with.

The explorer post is done entirely by volunteer work by the staff and involves almost two hundred students.

The -- on science bowl is a competition among teams of students from various high schools, institutes and summer --

DR. JENKINS: What are the minuses

for this?

DR. SPRINGER: There are no minuses.

DR. JENKINS: We can't see any back here.

DR. SPRINGER: I'm sorry.

(LAUGHTER)

DR. SPRINGER: Those figures are estimates. They're not drains on the system.

The other thing that is underway is discussions between the Science Foundation and the Department of Energy on a major collaboration.

And the primary focus of the moment seems to be at the pre-college level. That would, I think, take the form of a program that would focus on teachers, which I think would be an excellent thing to do.

So in summary, of those programs, I think they are, many of us think they are truly an exemplary program that successfully do stimulate people to do on to graduate school and pursue careers in R&D and they do that in more than normal proportions for the group that you're particularly interested in.

Switching now to the second subject, the data on employment as shown by these two things.

I should point out that there's a difference between the data for these two programs. The minority information that I gave you on the college-university programs does not include agents.

That's just the way we collect the data. We don't think it's as important in that instance. That's for Blacks, Hispanics and native Americans.

These are EEO statistics and we do end having Asians included in this. So we are at least pleased with the fact that during a period when there was somewhat of a decline in the employment at the laboratory, we had at least a modest increase in minorities and females.

The number of Blacks, Hispanics and native Americans that are employed at the lab are not what we would like it to be at all. I mean that reflects the fact in part that the pool of applicants from which you can draw for positions that are in an advanced research facility is very low.

And that gets us back to the programs that you need to have in place to increase that supply.

The lab, of course, does have a standard, active, affirmative action program. In addition to that, it's involved in these programs to help increase the supply.

One is one for women who have been, women chemists who have been out of the field for a while and want to get back into it, particularly in analytical chemistry, a program, internships for the handicapped that we are now developing, trying to put in place.

This is a mentorship sort of operation designed to give them a kind of experience that would enable, better enable them to go out and get a regular, full-time position.

We are also seeking support for a special program for potential scientists among high school females and of course we have been participating for a long time in the GEM Program.

And then I would go back and say again that these are not separate subjects. The laboratory itself, as an operating laboratory, is very much involved in this DOE Educational Program.

And the best data I can give you on that is that forty percent of the funding for the students involved in that program comes from the laboratory.

So this is also a major effort on the part of the laboratory, the programs I mentioned earlier, to increase the supply of these people in general and minorities and females in particular.

CHAIRMAN OAXACA: If you were to discount the Asian-Americans, how would your previous chart look like, what would your previous chart look like?

DR. SPRINGER: As far as employment go?

CHAIRMAN OAXACA: As far as, yeah, that particular thing, I mean --

DR. SPRINGER: I don't have --

CHAIRMAN OAXACA: Do Asian Americans give you a bias in one direction?

DR. SPRINGER: Oh yes, yes. If you look at, just look nationally I think it would be typical. Nationally, I think the figures are that Ph.D scientist and engineers are fifteen percent minority, but if you eliminate Asians, just about one percent, about fourteen very high percentage -- and I think we would reflect that.

I don't have numbers on it. I don't know if --

DR. LEBOLD: About four to one.

CHAIRMAN OAXACA: Ms. Freeman?

MS. FREEMAN: Are those Asians U. S. citizens?

DR. SPRINGER: The ones that are employed at the laboratory.

MS. FREEMAN: Are the ones that are going through the Ph.D. programs and the ones that are employed --

DR. SPRINGER: The data I gave you about the educational programs, that is this, these minority figures do not include Asians.

MS. FREEMAN: Okay.

DR. SPRINGER: But everybody involved in this program is a U.S. citizen.

MS. FREEMAN: And at the laboratory--

DR. SPRINGER: At the laboratory, you are not required to be a U.S. citizen to be employed there and I don't know what the percentage is of those that would be a permanent resident.

CHAIRMAN OAXACA: Dr. Danek.

DR. DANEK: Yes, do you, I mean, can you give us a feel for the magnitude of the investment that's being made by the Department of Energy and all of these activities on a yearly basis?

How much money is the department putting up in comparison to this total project?

I mean what's the budget for the university research program out of Rich Stevenson's office?

DR. SPRINGER: The national, this is called the Department of Energy Laboratory University Cooperative Program and as best I remember, the national budget for that is something around seven million dollars.

DR. DANEK: And is all of that--

DR. JOSEPH: -- seven million, half of which -- research -- budget which is about fifteen million.

DR. DANEK: So the total for the whole picture here is about fifteen million, of which for all programs of which, how much would you say

DR. JOSEPH: Did you hear what Dr. Springer said? And that we have education monies that are matched by program money at the laboratory.

DR. DANEK: But you'd add that though, right?

DR. JOSEPH: Forty percent of the education programs at the laboratory are funded by programs outside of U.S. So you have more than fifteen million.

DR. DANEK: Okay. So what is it, you almost double it.

CHAIRMAN OAXACA: Dr. Bell?

DR. BELL: How are the undergraduate students selected for participation in the program?

DR. SPRINGER: There is a very elaborate process involved in getting the information about the availability of the appointments out to the people in various schools and we have participants in this program from virtually every state in the country.

They apply for it, they are given information about the kinds of projects that are available and they indicate their preference.

Then there is an effort made by my

staff to make a match between the student's interest and the background and mentors that are available to do this sort of thing and the selection is made on that basis.

In the case of minorities, the extra emphasis that's put on there is put on in terms of funding. The minority students that any staff member wants to work with are fully funded by my division.

There is no share, there is no requirement for them to put in programmatic funds in at all. So that's the way that it's biased in that direction.

CHAIRMAN OAXACA: Dr. Rios?

DR. RIOS: Dr. Springer, I guess I must tell you very candidly that I'm very, very uimpressed with the statistics that you presented and in fact quite the contrary to refrain that it's, that the DOE is doing a great deal, I think it's an indictment of the DOE.

For example, out of two hundred and eighty-two (282) students, only ten percent are minority at a national lab that's close to Chicago where there's a very significant Hispanic and Black population.

And in fact, even some of those are women so the percentage if you were to separate those, the minority women from the total commitment pool, the percentages might be a little bit different, but that's a detail.

Ten percent is very unimpressive and if you look at the graduate students, only four percent out of a hundred and four (104). It's a national lab that should be looking, not only predominantly in this area, but also on a national basis, because when you look at the employment statistics and minority groups make the claim, well look you have a significant minority population and typically the answer is, well we recruit on a national basis.

So, similarly also for your programs, faculty out of ninety people only nine percent are minority, people on sabbatical, seventeen, none are minorities and none are women.

And it just reflects to me the network that exists, certainly at the sabbatical level, people coming from institutions and the fact that minorities are not part of that network -- the state of the art basic research at a national lab like Argonne.

Furthermore, if you look at your university Coop Program where you say the total program is about three times what Argonne is doing, can you tell me how many national labs there are in the country?

DR. JOSEPH: Ten.

DR. SPRINGER: No, no. There are many more than that.

DR. RIOS: Many more, there's hundreds.

DR. JOSEPH: Ten national labs -- seven hundred federal labs in the U.S. Government. Most of those have below a dozen people working--

DR. RIOS: Well, the point is, of the major national labs there are ten, but there are many more national labs that should, could perhaps follow the same model.

There are many DOE, government-owned and contracted operated facilities that have research and development.

DR. JOSEPH: Thirty two of them.

DR. RIOS: So when you say that three, the total effort on the university Coop Program is about three times what Argonne is doing, that's very unimpressive in my judgement.

And furthermore, the fact that eighty to ninety percent go on to graduate degrees, that to me reflect the very selective pre-screening that is done at the national labs, as perhaps they should.

So I think that quite the opposite, I think the statistics clearly show, particularly with a percentage of employees that the National Labs, that, and when you take off the Asian personnel, was that in the R&D engineering and R&D categories?

DR. SPRINGER: Those are the three

top EEO categories, that's managers and professionals and technicians.

DR. RIOS: And what you're telling us is you're down to one percent when you take out the Asian personnel. Is that correct?

DR. SPRINGER: I think that's probably right. That's an estimate.

DR. RIOS: So it seems to me what you're doing here with these programs is very, very minimal and basically have little or no impact on increasing this one percent component.

DR. SPRINGER: Well, I would only say that you should look at these figures in terms of the fact that the department is a mission agency and the primary purpose of these programs is to draw people generally into research careers that are pertinent to that mission.

In doing that, we put an emphasis on minorities and women, which brings them in at a level which is at least as high as their normal representation in the case of women and in the case of the minorities three or four times as high as their representation in the number of graduate programs.

So I think the emphasis is there.

DR. JENKINS: -- if you've looked at that data over a series of years and did you notice a drop in Black participation as was experienced in hiring --

DR. SPRINGER: No. My recollection is, I don't have that data exactly, but my recollection is that it has been very --

DR. JENKINS: Because one of the things we could consider is whether having these clients for contacts with National Laboratories or other -- they have hands-on experience is a good retention mechanism for minorities.

CHAIRMAN OAXACA: Mr. Hernandez.

MR. HERNANDEZ: Does your lab have any specific research programs with universities in this state that you provide funding to the university but at the same time identify a percentage of minorities or women to participate in those research programs as part of the graduate work is concerned.

DR. SPRINGER: There are, there is an extensive set of collaborations that go on between staff scientists and university faculty in research.

They're funded in a variety of ways. Some of them have essentially separate funding. The lab people being funded by the Department of Energy and the faculty people perhaps by the National Science Foundation.

In some cases it's shared and the money comes through DOE and in some cases it comes the other way too.

I'm not aware of any of those which allocate a specific part of the research dollars. I think that's what you're asking.

MR. HERNANDEZ: Or a goal or objective like the contracting clients has in regards to, if you have a federal government -- want you to set a goal of twenty percent minority and women for the --

DR. SPRINGER: If those goals apply

to the funds that support the research, then of course there is that, but for the most part, I don't think the research money that comes to the laboratory from the department is constrained in that way.

CHAIRMAN OAXACA: Dr. Springer, one of the things that we're trying to accomplish here and you can see that this is a major, major problem for our nation is to attempt to put together a report that has a mechanism for change.

I was disturbed by the statement that the minorities represented what is the normal representation. The normal representation will do us in in the future, because the normal representation is changing from a demographic standpoint that you cannot live what historically been a normal representation.

I would ask, we had the same sort of discussion with the folks from San Deal Laboratory in Albuquerque. There seems to be a trend there that, that an organization has a tremendous number of laboratories could do things above and beyond what's currently happening is the feeling that I'm getting.

And I was wondering if you would have any suggestions for the task force that they might implement to get the leadership of the Department of Energy to recognize that it appears that they are not doing enough.

DR. SPRINGER: The thing that I know most is what about these programs and the extent to which they work and how they work.

And I would point to the figures for the pre-college in terms of the most important way that one can increase the percentage in the undergraduate curricula and therefore in the programs for college students and so forth.

And then I would say that as far as mechanisms go to help address the problem, the kind of mechanism that this is in place does clearly work for the purpose of keeping people involved in education and keeping people involved in science careers.

And that could certainly be

generalized in lots of ways.

CHAIRMAN OAXACA: Thank you very much. Thank you very much.

MR. BIAGLOW: I just want to make several comments.

One of the things I've noticed, a lot of times we talk about percent of minorities being hired and everything.

A lot of times the goal is set, want to hire thirty percent minorities, but the available pool of talent out there is only ten percent.

So you've got all the national labs throughout the country competing with a goal of thirty percent, but yet there's only a pool of ten percent.

So that means that even, if you've got ten percent and maybe the pool that's out there is forty percent, you're winding up with double what somebody else is getting.

It seems like this goal of thirty percent is what we're aiming for and I just wanted to point this out, because sometimes the goal -- meet the pool.

The other thing I wanted to comment on is the program for the internship for the handicapped. And I think you will be very foolish not to put on a committee a group of your own handicapped workers as a handicap counsel to direct and to instruct any handicapped people you are bringing into your organization.

Because they are aware of your facilities, they are aware of the ability to move around the labs, they're aware of how to travel, why to travel, things to do and I think there's a highly emotionally -- any organization to have a handicapped counsel.

DR. SPRINGER: That would certainly be done.

CHAIRMAN OAXACA: Dr. Joseph.

DR. JOSEPH: I'd like to followup on who -- ask and give you a few figures on the overall Lab Coop program of which this is one laboratory. Then, too, make sure you understand that this is not a minority program.

This is national program aimed at increasing the pool of scientists and technologists across the board from which the Department of Energy also draws.

And in the overall program in terms of a little less than a thousand that are involved in the Lab Coop Program, eighteen percent of the national program is minority and twenty-four percent is female.

In the undergraduate program, thirty percent are female, nineteen percent are minority.

In the graduate program --

DR. RIOS: Excuse me, Mr. Chairman, is the purpose of the task force for the members to be able to amplify testimony of the witness on behalf of their agency?

DR. JOSEPH: The reason for looking at this --

CHAIRMAN OAXACA: We'll make a ruling in executive session.

DR. RIOS: Okay, thank you.

DR. JOSEPH: The reason for this is to demonstrate that when you look at one part of the program, you need to understand it in the context of the national program.

If you want to review that program as a model, that could be expanded from department to other departments, I'm talking about thirty-two laboratories in the Department of Energy that has a program like this that has some targets for minority and women participation in a government bureaucracy of seven hundred laboratories.

I think we need to look at, and each time an individual program and keep it in the context of the department.

That's the reason for expanding on it, not to sell you the program. We don't have that problem. We have --

CHAIRMAN OAXACA: Very short one now, last one, otherwise we're not going to get through all the testifiers.

MS. FREEMAN: What I'd like to ask

of you and the other national labs is that you, as the educational director, make it a top priority to reach the leadership of those labs to raise the stakes, so to speak, in terms of the importance of expanding the pool that you will be drawing from.

And to join with the private sector and the public sector in our hopefully national campaign to heighten the consciousness level of this nation and employers like yourself that there needs to be greater emphasis on the dwindling pool and the dirth of real hands-on programs to reach minority and female students or individuals who --

CHAIRMAN OAXACA: Let me interrupt, Ms. Freeman or we're never going to make it through the pass.

MS. FREEMAN: Okay. My point is--

CHAIRMAN OAXACA: Let me clarify a little bit as we talk about here.

The purpose of the task force and since, you know, these are controversial issues, I would ask the members of the task force to listen to the testimony, ask questions.

I would ask the members of the task force to confine the questions for information for purposes of what we will then discuss in executive session.

Otherwise, we'll never make it through the pass. This is, I'm enjoying this tremendously, but we could go on forever because this is a real problem and, you know, it's very gratifying to see that everybody's excited about it.

With that, I'll ask Mr. --

MR. LAUGHTER: Let me just point out one thing, because I haven't asked a question in a few sessions and I've come a long way.

CHAIRMAN OAXACA: Sure.

MR. LAUGHTER: I disagree with you. I think that if there are people who ask questions or state facts and there are people in this task force who are in their groups that have better facts, I want to hear them and I think the rest of us do.

And I didn't appreciate it and I think that we need to hear what they've got to say.

CHAIRMAN OAXACA: Would you like to comment on that?

DR. REYNOLDS: I certainly concur if there are facts to be brought to bear to elucidate testimony, however, I think it's my clear understanding and that of my co-chairman, that we are here to glean information from people speaking in front of us, that there are facts that relate -- but we are not here to -- agency programs.

I think we all share in the future by the total work of this task, but that has to occur within our --

CHAIRMAN OAXACA: I certainly --

MR. LAUGHTER: I know, but if we go back about three or four months when we get into this we'll forget a lot of the things.

CHAIRMAN OAXACA: I certainly will walk that fine line to make sure I don't upset you.

Let me ask Mr. Anibal Taboas, also from the Argonne National Laboratories --

(LAUGHTER)

CHAIRMAN OAXACA: How do you like the show so far?

(LAUGHTHER)

MR. TABOAS: (SPANISH ACCENT) I'll correct that, I'm not from Argonne National Laboratories, I'm from the U.S. Department of Energy, which is located in Argonne.

Thinking how to start this to make sure I had everybody's attention to begin with, I thought about saying something like in Alcoholic Anonymous, saying I'm Anibal Taboas, I'm a minority and I am partially handicapped.

But I talked about it with my six year old daughter and I asked her are you Black or White? And she thought, she looked at me, she thought it was a trick question.

And she said I'll think about that one, give me another one. Okay, are you Puerto

Rican or American? Daddy, you're trying to trick me, I'm all of them. And we are.

Okay, so I lost that opportunity. I like the fact of being minority, it's like Avis, it makes me try harder and in terms of the handicapped, it's more mental because of the physical condition.

It allows me to use it as an excuse sometimes to not try, to not aim as high as I possibly can go.

But let's put that on the side. I'm a bureaucrat and I just returned to the Argonne area, representing the department and I'm here to speak primarily for Chicago Operations Office which is one of our eight -- offices.

Argonne is one of our facilities and as of about four months ago, I am the Area Manager -- overseas, specifically Argonne National Labs.

I'm not here to go through an audit, a review of performance, but I'd like to highlight some of the actions that we've taken to deal with -- employees and with some of our contractors that we think are efficient to help in this area. And also perhaps more importantly to give some suggestions for your consideration.

I won't address things like the, our contribution to the Museum of Science and Industry. We have some exhibits there that are seen by large minority groups, nor will I address what Argonne is doing, nor Fermi Lab, which is -- of those have their own representation here today.

I say from the federal side first, our local office which is called -- some of the things we are proud of is like you have what you call, a partner in the school.

This year is the Joliet Central High School, which has a very high minority population. We adopt this school, we do laboratory tours, we do technical counseling, we essentially whereas allowed by regulation of law use of, donating scientific equipment for use in their classrooms.

There is a heck of a lot more

activities, including a five-year affirmative action plan, etcetera, which all employees are asked to participate on.

And even though we feel it's successful and feel it's a model for other DOE agencies, it's entities, that something I would like to say, heck that's required by regulation anyway, so just doing a good job of complying with regulations.

We say that DOE predecessor organizations, Atomic Energy Commission, the Energy Research and Development Administration and its many contractors had few women or minorities in scientific or technical fields.

In the past, the available, qualified recruits in this area were few. But things have changed and our opportunities are much broader now.

We do things like, actually we -- for them, we do management intern programs, we bring them into the department and show them what government is like.

We're, my office is proud to have had the first senior executive service female in the department's field structure and well that's essentially past history. There's at least two or three now.

But particularly in that area of the senior executives is an area that we have to do a lot of work on.

I personally believe that role models and mentoring are of almost necessary for essentially lower grade levels and mid-level employees to reach the professional categories, if they ever plan to reach the super grade levels.

One of my favorite models in that area is Dr. Gale DePlank (sic). She is Director of our Environmental Measurements Laboratory in New York City. She is a physicist like me, employed by the department and among other things she President-Elect of the National American Nuclear Society.

There are a few of those role models available, but in all honesty we share frustrations on getting, to be able to hire people, to be able to keep them and become motivated.

One reason is our salaries can't compete with the commercial sector, private sector. Another one has to do with the -- that has to be done with the, from the perception of what civil service is all about.

I'll try to highlight a few things that work. For example, at AIMS, one of our laboratories in Ireland (sic). They go out of their way on the HBCU, the historically Black colleges and universities program.

They hired twenty-five female graduate assistants and they, more than eighty percent of them completed their doctorates, because, as part of this program.

The Brookhaven National Lab in Long Island does, bring high school science fair winners to spend summer at the laboratory and see, experience Brookhaven hands-on.

Of fifty-seven students in the last

class, fourteen were women, five were minorities. These are not necessarily affirmative action programs, but it's an area in which we're getting what's called respectable representation.

Our Princeton -- Laboratory, which is what we call real high-tech fusion. They have a general maintenance apprenticeship program, which earmarks minorities at more the technical level to become apprentices to welders, sheet metal workers, electrical -- etcetera.

And most of these offered full-time primarily employed positions at the laboratory at the completion of their apprenticeship.

At -- our solar energy research institute in Boulder, Colorado, they, I think it's a form of program known as Gifted -- Intellectual -- Achievements, which is essentially a mentoring program for the high school level.

And it is done by scientists that essentially give their time and get some leeway from within the organization to use some of paid time to provide this one-on-one mentoring. This ain't going to make the front pages of the papers, etcetera, but it shows the level of commitment.

I'll go to, we'll call them suggestion, but I call them from my personal experience some very narrow areas where I think that help could be, would be appreciated.

First is to foster non-competitive promotional opportunities for minorities, women and handicapped. This isn't as hard as it sounds. This can be done from within existing regulations. It just needs somewhat of encouragement.

An example of this is to define an educational -- program and to compete for people to go into that program and use the use the competition to get into that program as to the certification or competitiveness and essentially complete the, the completion of certify non-competitive eligibility for placing, for placement at this higher graded professional categories.

This is, has been done experimentally, I guess onto a limited scale on people that are interning qualification class for senior executives.

It has not been done at nowhere great levels and it has not been earmarked for essentially targeted groups.

Another way would be to select, I call bright stars and assign them mentors to foster their careers.

This used to be done in the old Atomic Energy Commission somewhat. This can still be done within existing regulations and it needs I think more of a round to it, getting around to it, getting the little kick to, incentive to do these things.

Second is increased cross fertilization of high school students with professionals from math and -- disciplines. Example, this is the presidents of -- classroom programs. It's done on a voluntary basis by primarily federal employees. It's done only in the District of Columbia right now, but this could be expanded.

And finally, continued realization that essentially women, minorities and the handicapped might require special attention in the infrastructure and I'm talking about, specifically of things like child care centers.

This concludes my -- testimony. I have more extensive information provided for the record with statistics, etcetera if you desire.

CHAIRMAN OAXACA: Thank you very much. Any questions by the task force?

MS. WINKLER: Got it out of our system.

(LAUGHTER)

MR. SCURRY: Mr. Chairman, I wouldn't want this witness to leave without any questions --

(LAUGHTER)

MR. SCURRY: We don't want to deviate. One of the things I might say as just a comment, as opposed to a --

CHAIRMAN OAXACA: That made Dr. Springer feel bad.

(LAUGHTER)

MR. SCURRY: (continuing) -- is oftentimes, I was rather impressed with the fact that he selected the high school science fair winners and you brought them in.

Also began to look at the two breaks you made in terms of statistics, fourteen women, five minorities.

Just for information or something to think about, you may want to consider the persons who came in second.

You raised the question of Avis, so I will also. I was wondering if, I think that when you look at persons competing in science fairs and you look at the true of folk doing that and of that smaller universe minority, you don't lose very much, in my judgement, when the runner up is also one who receives a Kudo or two and is asked to also participate in this type of program.

And you might want to consider that. And I certainly don't think you lower your standards one bit when you bring in the number second or third person in a contest of this nature, especially when you look at most of these fairs, statewide or countywide and involve an awful lot of brilliant youngsters producing a fantastic product.

Just a comment.

MR. FERNANDEZ: Mr. Chairman?

CHAIRMAN OAXACA: Yes?

MR. FERNANDEZ: Following your direction to be specific with questions --

CHAIRMAN OAXACA: Thank you.

(LAUGHTER)

MR. FERNANDEZ: You've been in the Department of Energy for several years. I met you when you were back in Elmhurst (sic), so you've been around a little.

Do you feel that the Department of Energy and the National Lab, more specifically suffering from a perception of affirmative action programs that says that sprinkle it, but don't worry about the bread and butter issues of employment?

DR. TABOAS: That sounds like a lose-lose question for me to answer. In fact, my experience has been that it is handled different at each location and that it is for the most part an extension of the, of the, I call it the nervous energy of the person in charge; such that if you get the bright individual in that is committed to this, then there is a change for however long that individual is in there.

I have not seen what I would call a long-standing commitment in terms of bottom line results with the possible exception of the, actually the extent of funding that has been put in this area by the Energy Research Programs.

That is the only extension with the exception to the level of commitment. Some good people have been involved in this and they are long gone and until another high flyer comes in this area, we'll be floating along.

CHAIRMAN OAXACA: Thank you much. The last testimony before we go down to McDonald's downstairs and try to reconvene at 1:30, will be

Dr. Arlene Lenox of the Department Head Neutron Therapy Facility of the Fermi Laboratory.

DR. LENOX: The process of integrating women and minorities into science really takes place in three stages.

There's the process of creating the pool and then recruiting the candidates into the appropriate jobs and finally, using the talents once we have the candidates there.

There has been a lot of emphasis on the second activity which is namely recruiting the candidates. Fermi Labs does that and they are no exception. You've heard a lot of testimony earlier this morning that that's true.

I would like to show you one list of our programs which is specifically aimed at recruiting minorities. I do not intend to go into the details. They are all included in the documentation.

I do want you to know that we are targeting high school people, pre-college and even graduate level people to try to get them into science.

We are also working with people who are not so-called college material who can become technicians or welders or whatever else. We do have jobs, CAP type programs, CETA Programs--

REPORTER: Could you speak up just a little bit, please?

DR. LENOX: CAP type programs and CETA Programs that we have been working throughout the history of the laboratory.

Nevertheless, as has already been pointed out and we are certainly well aware, the representation of minorities and women in the scientific community, in general and also in Fermi Lab is not what we would like it to be.

This table is in the documentation that I gave you, so I apologize if you can't read it here, but I felt we had to get it front, but you also have a copy of it.

I've broken down the laboratory staff, this is the entire laboratory, two thousand thirty-one (2,031) people into what I call scientific professionals.

This includes people who have backgrounds, lots of Ph.Ds, Masters, etcetera with scientific backgrounds and let me just say professionals are people who are monthly who are staff. They don't have to punch the weekly time cards -- time chart, they consider themselves to be professionals. Then the the non-scientific professionals including people like librarians, the manager of the public relations office, etcetera. Technicians, office and clerical and then -- service workers.

In the top category here for Ph.D. physicists, there are on regular staff two hundred and thirteen Ph.D. physicists, of these, ten are female and twenty are from minority groups.

We get the physicists, are dominated as you see by the Asians and that's why I broke them out. These are people who are visiting at the laboratory say for one year, they are not part of the regular career track program.

We have ten Hispanics, these are people who are citizens of South America. They are the laboratory on a Hispanic exchange program. They will be here for a year or two and then leave there, not part of the regular track.

Women, bottom line, three hundred ninety (390) women out of a total of two thousand thirty one (2,031) at the laboratory, nearly one third of these are in office and clerical work.

Black males dominate, there are a hundred and twenty (120) total dominating number -- in technicians. These are not highly educated people.

So this is what the background is and I'm sure that this is not a surprise to you. I would like to give my own personal view on what we can do to correct this.

I have worked with these programs for years, I've been involved with recruiting them, in particular, one where we deal with the HBCUs and actually go down to the south to recruit students from these small colleges and we just know that the pool isn't there, so I've agonized over it for a long time.

I think the problem is that there is a perception among minorities and I know that there is a perception among White females that they are not necessarily welcome in science, that they are not going to feel good in science.

We are not going to get minorities and women actively participating in science until they and their parents, parents of pre-school people perceive that there is a place in science where these people will be comfortable and welcomed.

So any national program that's going to try to get more representation from women and minorities in science is going to have to address that issue.

They have to know that they are welcome and the parents of pre-school children have to be told what the educational background has to be, what sort of experiences, growing up and learning experiences the students have to have, starting from very young, playing with blocks and erector sets, very special relationships, etcetera.

I think if we're going to target money into programs, those are the sets of -- we have to go for and not more of the same, because it's been pointed out the same that we've had so far don't really seem to be putting more people into the scientific pool.

And I want to emphasize we have to start in pre-school and we have to get to the parents of pre-schoolers.

The other thing that we have to look at is the business of using the talents. The young people coming into the community today are much more sophisticated than we were. They not only ask, graduate students who come to me and say, "I want to go into this field, what's it like?"

They not only ask how much money will I make, they ask, how will they treat me? If I go into that department, how will I be treated?

Here I am a Ph.D. scientist, I expect to have a certain respect, etcetera.

People who are playing the game in order to get tenure at a university cannot be doing good science -- too interested in playing the game to get the tenure.

People who are playing political games in order to get money because they want research grants are no longer doing good science -- too involved in politics.

The non-political people and these non-political people tend to include women and minorities, these people sort of put their nose in the books and put their nose in their research, they get engrossed in what they're doing.

Five or ten years later, they wake up, they realize they've been passed up for promotion, they realize that their salaries are much lower than the other people because they have not been political.

So we have to somehow look at the minorities, at the management so that women and minorities can get in and try to do good science and not have to be victims of this political system.

Therefore, I think that it is time to somehow restructure our management of scientific personnel and I want to present as a starting point a model that was presented by Marilyn Loden in her book called "Feminine Leadership."

These are the primary features of her model, this table is taken directly from her book. She emphasizes teamwork and cooperation in opposition to competition and the hierarchy structure. Her emphasis here is quality output, putting out a quality product, and that's where the scientific research whether you're in business or industry or whatever, and deemphasizes winning.

Because a lot of times we can win, but the quality is not there. And in the long term, everybody loses.

I'm hoping that if one thing comes out of this task force it's that they can perhaps get the scientific community to re-evaluate the management structure and to start moving in the direction, something like this one.

Thank you.

CHAIRMAN OAXACA: Okay, thank you very much.

DR. LENOX: Yeah.

CHAIRMAN OAXACA: Questions for Dr. Lenox.

DR. JOSEPH: Well, I have one. I'm not sure you might know the answer, but something that occurred to me from your data that I hadn't thought about were more or less looking at Asians of non-minority groups.

DR. LENOX: Pardon me?

DR. JOSEPH: Looking at Asians of a non-minority group. Looking at your occupation for Fermi Lab, I'm surprised to see that you have only one female Asian who is in the lower technician category in your total staff --

DR. LEN[illegible]. Interesting, isn't it?

DR. JOSEPH: Maybe we're wrong in

not seeing females Asians as a target of opportunity -- minority. And I have to admit, I really have a stereotype, I guess I had thought that that wasn't the case, but you know, I know hydrogen physics isn't exactly a model for the rest of the country, but if that's case, I think we should be looking at whether there are targeted programs for females in Asian culture, like there should be for females in the Spanish-American or Indian culture --

DR. LENOX: It certainly seems that the male Asians, I mean if you look down at this--

DR. JOSEPH: Oh, I agree.

DR. LENOX: (continuing) -- it was interesting to note where they are. You don't find male Asians in these lower level activities. All the male Asians at the laboratory are up here in the very top category, highest educated and highest paid.

CHAIRMAN OAXACA: Stella?

MS. GUERRA: On your Hispanics, the number ten, you said it was a special program or an exchange program --

DR. LENOX: The laboratory has a program to get higher -- physics started in Latin America. We have an exchange program where our high energy physicists go to Latin America and work with their university physicists and their people come back to work at the laboratory, but--

MS. GUERRA: Is this an on-going--

DR. LENOX: It's an on-going, it's been going on for some number of years now, but I wanted to break that out because these are not the Hispanics that are living in Aurora, these are visiting Hispanics from Latin America.

CHAIRMAN OAXACA: All right, Herb Fernandez?

MR. FERNANDEZ: -- questions so that the representatives of the Department of Energy and the national labs don't feel like they're being picked on, but this is the national resource.

DR. LENOX: Yes.

MR. FERNANDEZ: And this is, these

laboratories are subsized by the federal government and therefore you have a very solid type of, very solid commitment to the taxpayers of this nation.

So we're not picking on individuals, I think we're trying to establish what can we do in the future so that this resource can be properly utilized.

But the question is, in looking at your -- your numbers here, there's almost a complete void on female representation at the physicist, associate physicist, engineering groups.

I wonder, do we have a tenured prone in the national labs that maybe those people have been there forever and we just don't have the vacancies up there so that --

DR. LENOX: Oh, are you saying, are there other women scientists buried in this, that are not up to --

MR. FERNANDEZ: No, it's a more general question. If you look at the top, one, two, three, six levels --

DR. LENOX: Yes.

MR. FERNANDEZ: (continuing) -- your top staffers in the science area.

DR. LENOX: Right.

MR. FERNANDEZ: I wonder if this is a pattern throughout the national labs that looks this way, and the question is, do we have a tenured prone that maybe these people have been here forever and you just don't have the openings for the new things --

DR. LENOX: There are openings, let me say from a personal point of view what it's, life is like in a national laboratory.

I am married, my husband works also at Fermi Lab. I am at Fermi Lab because and I chose to stay at Fermi Lab because there is this problem where you have two professional people.

He is, my husband and I are both in that top category. Now where can you go where you can get a job? I can't go to some university and become a faculty member and find it likely that they will also to support my husband, who is exactly in the same field.

National laboratories are wonderful for people, in fact all three of the women in the very top category are in the situation where their husbands are also employed at the laboratory.

Good reason to stay there, it's a big enough place where you can stay. Other women who come through who have the choices would, many, in many cases, would prefer academia.

And since they have their choices, they go there. The laboratory actively recruits women and I have, in fact, been invited to entertaining dinners when we have couples and we're trying to recruit the women.

But they almost invariably choose to go to academia and I, well I'm happy at the laboratory right now, but I would say that when I finish my post op (sic) my first choice would have been academia. But because of the marriage situation, I stayed at the lab.

MR. FERNANDEZ: I assume that the

answer to my answer is that there are vacancies, there are --

DR. LENOX: Yes.

MR. FERNANDEZ: (continuing) -- opportunities, but for some reason we're not getting --

DR. LENOX: The pool is not there.

DR. DANEK: I can respond to that pool. For example, I think it's very important because you beginning to look at the problem in a disaggregated way and I think that's very important.

If you were to look at, it this were an NIH laboratory, you would not see that same situation.

DR. LENOX: You'd have biology.

DR. DANEK: You'd have, because of the fact that if you look at the proportion of women who hold Ph.Ds in a "the research," say that they are primarily engaged in basic research, eighty-six percent of them who hold the Ph.Ds are in the biological and social sciences field.

So the pool of potentials and the worst pool is in the physics community, so you're looking at a very small group of people that you can, that can be put into those positions.

And that's where, that's where the problem is with the system.

CHAIRMAN OAXACA: Ms. Freeman and then Dr. Reynolds and then Dr. Rios.

MS. FREEMAN: You mentioned, I think, a couple of pool expanding programs. Is your lab involved or are there thoughts of getting a program going that would be focused on expanding the pool, like going into the high school, college, untapped areas perhaps?

DR. LENOX: The target program goes into the Chicago city schools, it bring minorities in for six weeks during the summer.

Our pre-college internship program goes to local people who have been accepted into graduate school at the University of Illinois Engineering School.

We bring them in for jobs in the

summer so they can get some work experience. This summer intership is the one that I work with most closely where we actually go to the south and recruit students from the HCBUs.

Yes, we are trying to increase that pool, but I would point out that these are all specific minorities. The lab does not have programs aimed at women.

But I think about this over and over and I say the problem is we are too late. If you start even looking at high school, it's too late, they're not there.

CHAIRMAN OAXACA: Dr. Reynolds?

DR. REYNOLDS: Very quickly, I think Dr. Lenox makes an important point, but I wanted to heighten one thing.

The kind of physics research you do there is highly collaborative research.

DR. LENOX: Right.

DR. REYNOLDS: Most high energy physics and in fact most physics is highly collaborative. Dr. Danek referred to the fact that many more women are in biology, which incidentally is a much more solitary pursuit.

Biologists can work alone, they can get grants alone, they can do things alone. And I just didn't want the group to miss this cultural involvement issue here that is really very important.

Because for a women to be in a group of physicists, a group of physicists have to have taken her in. That point needs to be made.

CHAIRMAN OAXACA: Dr. Rios?

DR. RIOS: Dr. Lenox, I just wanted to make an information comment here, having been a low and medium energy physicist myself.

Currently, the Society for the Advancement of Mexican Americans and Indians in Science meeting in El Paso and historically that group has been supported much better by institutions such as the National Institute of Health and for that reason it has something to do with the fact that there are more minorities in the biological science as opposed to the physical sciences, but that group has never really been able to penetrate.

As an example, the infrastructure of the national labs so that in fact even though there may be very few high energy physicists, I know that the national labs hire solid state physicists, etcetera --

DR. LENOX: Not Fermi Lab.

DR. RIOS: Well, perhaps not Fermi Lab, but it's, you know, in general it's a multidisciplinary effort, everything from the detectives that require other -- so on.

And it is a resource that in my judgement has not been tapped that can perhaps begin the impact on for example the visiting physicists and on the, forming that infrastructure where you get such as in the Argonne National Lab faculty students on sabbatical -- students for the summer -- open access to the national labs in a physics realm.

CHAIRMAN OAXACA: Thank you, Doctor. Oh --

MS. HANSHAW: Quick question. The nepotism regulations at some federal labs -- kind of husband-wife positions that you have indicated, I wonder what the nepotism regulations are, if any.

DR. LENOX: I'm not aware of any.

CHAIRMAN OAXACA: Thank you so much, Dr. Lenox.

MR. LAUGHTER: Can I just say one thing?

CHAIRMAN OAXACA: Yes.

MR. LAUGHTER: Please, because we're each protecting our own groups.

(LAUGHTER)

MR. LAUGHTER: For you information, you mention McDonald's. I happen to be a member of the women's board of directors, so if anybody's around --

(LAUGHTER)

CHAIRMAN OAXACA: Thank you so much, Dr. Lenox.

Let me make the point that we would

ask everybody to get back that's going to be testifying and, by 1:15.

We're trying to make up some time. We have given short ~~trip~~ shrift to the two folks from Purdue that were scheduled for this morning.

We don't want to do that. They'll be back. I would encourage everyone for 1:15. We got some very exciting testimony this afternoon, probably even moreso than this morning.

Thank you very much.

(LUNCH BREAK)

CHAIRMAN OAXACA: We about to start our afternoon testimony.

First of all, let me personally apologize to Dr. Jane Kahle for moving her up an hour. She was scheduled for this morning, along with Ms. Daniels, but it got a little exciting this morning with the tremendous topic we're discussing and so we're very grateful to you for bearing with you and we thank you for taking the time to stick with us this afternoon for the testimony.

Welcome.

DR. KAHLE: Before the time starts, I hope to just say one thing. I have done a lot of work with minorities and women at the secondary area and with the cooperative programs that someone asked a question about this morning.

But this afternoon, I want to limit myself to one area of the problem, because I think that's the only way to come up with feasible solutions.

Who will do science? We all ask and the decision about who studies science we've heard this morning, and it has certainly been my extensive experience, is made usually unconsciously by thousands of students in their junior high school years.

And those thousands of individual decisions are almost always made by neglect. Neglect of information, neglect of understanding, neglect of life expectancies.

Later on, many of the girls and the minorities who initially choose to continue to study science and math will make another decision, usually voluntarily, to opt out of the scientific or technological career.

Those two decisions, one based on neglect and the other on circumstances beyond their control will mean that after another decade, neither women nor minorities, who together constitute sixty-two percent of our population, will be adequately represented in doctoral programs or as practicing scientists.

And because I find the issue complex, I'm going to limit myself to talking about women only and women at the area of higher education and in the work place.

Betty Vetter is one of the people who does, supplies all of us with good statistics and as Betty as pointed out, there has been little change in what has happened with women in the last decade.

In fact, we need to be very concerned that there is a current complacency grounded in the increased numbers of women doing science, which is ill-founded.

Because of the increase in the numbers of women has to do with an increase in the proportion of women doing all advanced degrees, I mean graduate and undergraduate.

The proportion of total degrees in science and engineering has changed, for women has changed -- since 1970 and in the doctoral area, none since 1950.

There's been and is still an inequality of access to higher education in science for women.

For example, women compared with men pay more for their educations, both undergraduate and graduate.

In addition, women receive fewer research assistantships. In eight out of eleven science fields, more graduate men than graduate women receive research assistantships.

In addition, recently in special recruitment and retention programs for women are being phased out. Therefore, continuing problems for those of us who labor in academia there's a higher attrition rate of women from undergraduate science major to graduate science programs.

Recently, we've had several studies at Purdue to assess why women leave science at the undergraduate and graduate levels. Two of my doctoral students had very interesting findings.

One assessed attitudinal and socio-cultural values influencing women and men switching from biology to a non-science major.

Although the women, compared with the men had higher grade point averages, personal factors affected those young women's decisions.

Some of those personal factors were related to future concerns, home-career conflicts.

Others related to what we call the campus and classroom climates, a lack, that is a role models, a lack of female friends in science majors and a male orientation in science and mathematic classes.

She was able to put together a prediction formula based on the surveys and the instruments she used to now predict which women are more likely to leave science in their undergraduate years.

Another students looked at those factors in a more narrow way. And she assessed those personal factors for women students in engineering, biology and nursing, all requiring high aptitude and interest in science.

Using a personal attributes questionnaire, she found that sixty-two percent of the engineering and sixty-four percent of the women students in biology selected characteristics which classified them as either masculine or androgynous.

Those characteristics, I find interesting, require high self ratings and such characteristics as self confidence and tenacity.

In addition, she found that more perspective women engineers had role models. She also coordinated a career seminar for undergraduate science majors, which was enthusiastically received and certainly helped our attrition rate.

Each of those studies shows that undergraduate women leave science, not because of academic difficulties, but rather because of personal factors and they suggest routes for action.

At the graduate level, an analysis of attrition rate of graduate men and women showed that at the Masters level we have an overall rate at Purdue of thirty-two percent; for men it's twenty-nine; for women it's thirty-nine.

Almost all of the seven percent female attrition beyond the overall rate can be attributed to field of study, however, it's a different story on the doctoral level.

On the doctoral level, there are significant difference between the men and the women's rates of attrition. The rates are overall thirty-three; the men, thirty; women, forty-six.

Two -- that women leave the pipeline -- are certainly borne out by our data. When she controlled the study for the conditions of starting year, residence, age and school, she found that thirteen percent of the additional attrition would be attributed only to gender.

Student responses to the same study indicate that graduate women, compared with graduate men experience less role congruence and less faculty support, irregardless of whether the field of study is traditionally female, androgynous or masculine.

Women perceive conflicts between their personal and professional goals. Graduate women believe that they cannot be honest with their major professor who do not treat them as colleagues and graduate women believe that male and female students are treated unequally.

As we move the workplace, the question concerning women, minorities and the handicapped clearly becomes who will be left to do science. The pipeline we've heard of narrows to a small tube. And again, those left in it are faced with inequality of access.

For example, although women compose

twenty-five percent of the total -- labor force in 1984, they made up forty percent of unemployed scientists. Women equal 21.1 percent of academically employed scientists and engineers in 1984, yet in major research universities, that percentage plummets.

At Purdue, for example, the female shared total tenure, tenured track positions by school is 7.3 percent for science and only 2.1 percent for engineering, yet it is nearly thirty-six percent for humanities, social science and education.

Overall in the Big Ten, the percentage of women in tenure track positions on main campuses varies from a 22.4 percent high at Ohio State to a low 13 percent at Purdue. And those percentages have held constant for several years.

We all know that women have, lower pay in both industry and government and receive fewer of the scientific awards and prizes.

Related to the lack of advanced

awards is the fact that women receive fewer earlier rewards and I will skip over a few pages and continue with what I think can be done.

I have one thing to say before I do what can be done and that is that there's recent evidence that there's a glass ceiling on women in academia similar to that that has been found for Blacks and other minorities.

At about twenty-five percent, academic departments quit hiring women, regardless of their production in the doctoral pipeline. Psychology and sociology are examples.

Now what can be done. The following recommendations have been gathered from a variety of sources. At the undergraduate level, acceptance of the non-traditional majors for women is usual, rather than those only for the very brave.

Scholarships and fellowships for students underrepresented in their areas. Cooperative efforts between colleges, universities and prospective employers, so that women have access to the technical workplace.

Identification of women most likely to withdraw from science using our bank of surveys and special counseling. Gender training for the international teaching assistance, whose cultural heritage may be very different than ours concerning gender issues.

Graduate. Orientation programs for graduate women. Special university travel funds for students underrepresented in their fields to participate at professional meetings.

Forgiveness of undergraduate loans for women, as well as minorities who continue to graduate programs in science and engineering, similar to what's being done for minorities at Columbia University.

On-site day care for parents. Employment, comprehensive federal family policy. Longer term grants for women researchers who may be juggling home responsibilities. National policy on maternity and paternity leave, flux time.

Child care extended to include sick children. Equitable salary plans. For example, the University of Colorado's Male-Female Counterpart Program. Increase in the number of women in full professorships and administration even if some professorships have to be invented.

Overall, publication of statistics. Grants to institutions so the proven model programs may be replicated, similar to MIT's new grant to study model programs for minority students.

And last, an expansion of the special research opportunity programs to mid-career women or those who are retrained.

In conclusion, much needs to be done. It has become evidence that equal educational opportunity to science and engineering are not enough. Reality is the workplace.

In peering through the looking glass, thousands of would-be -- see that twenty-three years after the passage of our great Civil Rights Laws, women scientists and engineers compared with men have lower pay, lower promotion, less visibility and fewer rewards.

Recently, I was part of a team sponsored by the INAS and Triple AS to review programs in Sweden.

During the briefing session, a representative from the Ministry of Labor asked how they could encourage girls to enter technical fields where they face discrimination in pay and promotion when there were plenty of jobs in the traditional female nurturing and caring professions.

I could not answer them and I cannot answer now. But I know that a healthy society and economy must encourage the maximum talents of all people and I hope you will consider the ways I've suggested.

Thank you very much.

CHAIRMAN OAXACA: Dr. Jeffers?

DR. JEFFERS: You used a phase in describing the reasons for the undergraduate women often have programs. I would like to request a clarification.

Male orientation in sciences, what does that, does it mean call it Adam instead of Eve --

DR. KAHLE: No, no, no. It has to do --

DR. JEFFERS: What does that mean?

DR. KAHLE: It's much more fundamental things that we know a lot now about structuring classroom instructions so that it's equitable for all students and both men and women benefit with this.

One thing is that you call on women students as frequently as you call on men students. You lecture less often. You make sure if it's in a laboratory science that girls are doing, handling the equipment because this was one of our problems with women at college and girls in junior high school; that they don't have these experiences.

You do use references to things that women do as well as things that men do. I've all kind of examples. In other words, you would use some machines that women are more familiar with and men are familiar with in physics class.

That would be of less male orientation. Typically, we're dealing with a middle-aged male professor who has the male orientation and is doing these things fairly unconsciously. But if it -- up saying this class is for half of you, not for the other half. Very subtle.

CHAIRMAN OAXACA: Any other questions for Dr. Kahle? Thank you so much.

And once again, my apologies for keeping you over.

Ms. Jane Daniels?

DR. REYNOLDS: I have one quick one.

CHAIRMAN OAXACA: Oh, the lady from Ohio State.

(LAUGHTER)

DR. REYNOLDS: I have one question and that was excellent testimony, well -- by data.

You've been studying this for some years. We heard earlier testimony from one of your colleagues that the numbers of women in engineering is leveling off.

Do you perceive that the momentum for women in biological sciences is leveling off?

DR. KAHLE: Yes.

DR. REYNOLDS: And you were implying that, were you not and you perceive that the impetus we had in the 60's and 70's has been slackened. May we surmise that?

DR. KAHLE: The impetus has slackened, the programs are diminishing, it's considered a problem that has been solved and --

DR. REYNOLDS: That's what I wanted you to say.

DR. KAHLE: It simply is not.

DR. REYNOLDS: Thank you, Doctor.

CHAIRMAN OAXACA: Thank you so much.

I would ask Ms. Jane Daniels, Director of Women in Engineering Programs, Department of Freshmen Engineering, Purdue University.

And to you also, a personal apology for letting macho man from Purdue be ahead of you this morning.

(LAUGHTER)

MS. DANIELS: Bill and I will fight it out on the way back home.

CHAIRMAN OAXACA: Actually, I was directed by a woman to do that.

(LAUGHTER)

CHAIRMAN OAXACA: You know, I'm used to just --

DR. JENKINS: There's no excuse.

CHAIRMAN OAXACA: (continuing) -- no questions.

(LAUGHTER)

DR. JENKINS: That's no excuse.

CHAIRMAN OAXACA: If you knew my mother, you wouldn't say that.

MS. DANIELS: Obviously, the programs at Purdue and the research that's been done at Purdue is extensive and prohibitive from talking about all of it today.

What I'd like to focus on are two things. One is the success our programs have enjoyed and I guess I would like to say that with a little bit of a disclaimer and that's, we don't have any feeling that we have the panacea for what's going on.

We realize that we, too, fall short of what we hope to accomplish, but we hope that some of the things we've discovered over the years would be useful to other programs that are trying to increase the number of women going into engineering.

And the second thing I'd like to talk about a little bit is some suggestions for future direction.

I'm of the firm opinion that we've reached saturation with the methods we're using to attract women into careers in engineering.

I think we've used primary a career information approach, approaching the young women that already have talents in science and mathematics and I think if we're to increase any further the percentage of women that go into these areas, we're going to need to look at some completely new and different things.

I won't talk a whole lot about statistics because I do think Dr. Lebold covered that a little bit, but I would like to show one statistic that I'm extremely proud of in regard our results at Purdue.

This is what retention looks like, standing on it's head --

(REFERRING TO MATERIAL UPSIDE DOWN ON OVERHEAD VIEWER)

(LAUGHTER)

MS. DANIELS: For students who began in 1968, our male students, if you look we're going out ten semesters, that's five years to when graduation occurs usually.

For the male students, it was a forty-five percent; for the female students at that time it was half, less than half, twenty-one percent.

Since the inception of the women in engineering program, this is what the statistics look like. The male beginners have increased. Sometimes I jokingly say that's because they enjoy it more now that women are around.

(LAUGHTER)

MS. DANIELS: But seriously it has increased for both, but certainly much more dramatically for women.

And the retention rate since this time, obviously these are students that graduated in '77, around that time period. Since that time, the retention has remained approximately equal and that's a fact that we're real proud of and hope that some of the programs that we have practiced for the last ten years are the cause for that.

We talk a lot about enrollments and Purdue's a large engineering school, so sometimes I think we get a little bit more credit than we deserve because we, yes, we have thirteen hundred women undergraduates in engineering and everybody goes "Whew, Wow, you know, that's really neat."

Well we have the largest engineering school in the country, we ought to have the largest enrollment of women students and we don't have the largest percentage of women engineering students.

So I think we still have a lot of work to do also. What we have accomplished though is graduation of our women student.

The slash line is the national percentage of women graduating with PS degrees, the total degrees conferred, the solid white line is those at Purdue, so we have maintained a graduation statistic of about two to six percent above the national average.

I want to just briefly tell about our programs. These are pre-college programs. I will have examples of all of these programs in a packet that each of you will receive after today.

Young women in the early grades

know that all kinds of women pursue engineering; that they don't have to be a specific type of woman; women with children, women of various races, ethnic backgrounds, women who stay in an office-type job, women who are in laboratories, every kind of women can pursue engineering.

A similar poster was developed about six years ago to attract the high school women and what we're getting at here is trying to attach to --

(LAUGHTER)

(MATERIAL ON DISPLAY
CAUSES LAUGHTER)

MS. DANIELS: (continuing) -- lots of women so come join us. We're looking for a few more good women in engineering and these are our students on the football field spelling out "Women in Engineering."

I almost lost my sanity --

CHAIRMAN OAXACA: Can you show that to the audience back there?

MS. DANIELS: We had four hundred

young ladies sign up to form these letters and when the morning appeared, two hundred of them showed up.

(LAUGHTER)

MS. DANIELS: I was not a pleased woman and I was so angry that when I got back to the office Monday, I fired off a note to the other two hundred who names I had --

(LAUGHTER)

MS. DANIELS: (continuing) -- and said that I really thought they were not taking full responsibility and da-da-da-te-da and really kind of laid into them.

Three years later, the president of our student section of the Society of Women Engineers came up to me and she said, "Do you know, for two years I didn't have the courage to walk into your office. I was one of those young ladies."

(LAUGHTER)

MS. DANIELS: We do newsletters, a slide tape program that describes fields of engineering and advantages for women at Purdue, opportunities for women.

What I'm very proud of is a movie and, that has been put on video that we developed last year.

Dr. Lebold mentioned an affirmative action award grant that we got for our women and minority program. And part of this grant was used to develop a movie that is generic, it's not a Purdue recruitment type film.

It is generic to women in engineering that I hope will eventually be in distribution throughout the United States.

We went out on the job, in the homes, in their personal activities with six alumni from the university in various types of jobs, various fields of engineering and we tried to show the young women again that engineering can become combined with a fulfilling family life, a fulfilling personal life.

So we show our women engineers teaching aerobics classes in the evening and playing cello in the symphony orchestra and jogging with a jogging club; things to let our young women know that they don't have to be atypical young women to choose a field that's not traditional.

Our outreach programs do focus on a continuum basis. This is one of the things we've discovered; that you can't do a hit and miss approach, to go in and attract the women with a one-time program or one flier or one poster.

So we do try to start with junior high school women and continue throughout their progress and education until they get to the university and we even have some programs for our alumnae to encourage their support of the on-campus program as they go into their careers.

We try to work with future counselors, we try to work with parents, we try and have a combination of things, as I mentioned on the continuum to attract these women.

On-campus programs include single day programs for junior and senior women in high school, a week-long summer program and again some teacher-counselor institutes.

Our financial programs are quite limited. One of the things you've heard is that programs have been cut back, funding has decreased because people assume the job is done. They had a tremendous growth, everyone kind of settled back and kind of thought, "just great."

It's not just great and the financial help that we've been receiving has decreased steadily over the last five years.

So the merit awards and the summer programs are all decreasing, they're becoming self-supporting, which means we have to limit enrollment to students who can pay their own way; not a choice that is attractive to any of us.

We have gleaned some encompassing principals from our programs and I'd like to share some of those with you.

One is career versus institution. I think if all of us, throughout the United States, would concentrate not on recruiting for our own institutions, but increasing the pool of young women that choose careers in engineering, we're all going to come out better for it and have a multiple effect, instead of each one of us doing our own thing.

The use of role models, I've heard pros and cons today about that a little bit. We seem to think it's just indispensible. Every evaluation we get back following our program, cites that as the single thing that the students enjoyed most about the program; was the opportunity to talk with women engineering students, the opportunity to talk with women engineers who are out in the work force.

We've that a minority focus is important at Purdue and I assume nationally I believe it's also tr there's a higher percentage of women among the Black students in engineering and among he Hispanics students in engineering than there is with Caucasian students.

So we feel that all of our women in

engineering programs must be sensitive to and address issues with concern to minority women, in particular.

The establishment of a support network I think is very important. This is why we have programs for parents and teachers, along with our programs for students so that they do have that support going with them after the program is over.

The individual contacts. We've seen from research that women respond to different things than our white males do. And they do respond to the individual contact of knowing someone in the field.

So I think the kinds of things we do with brochures and posters is fine, but it certainly doesn't solve the biggest part of the problem. Continuity and variety, I mentioned before, that's an important thing.

One of the things I mentioned was the decline in support and this is the national survey that we finished last year about women in engineering programs throughout the United States and I will be making a director available to all of you that summarizes what programs are available throughout the United States.

It covers two hundred and eighty (280) schools in the country that have engineering or pre-engineering programs.

You can see there's been a decline in every area, from 1982 to 1987, except for scholarships and fellowships, but all programmatic activity has declined across the board.

DR. DANEK: Who is responsible for providing the major source of funding? Is it the universities themselves and/or who else?

MS. DANIELS: Industry has provided much of it. Government, NSF programs have done some of the --

DR. DANEK: They've gone down?

MS. DANIELS: (continuing) -- pre-college programs. That has decreased, yes.

DR. HAINES: What's your "X" factor?

MS. DANIELS: I'm sorry. The percent of colleges and universities that have those programs. The high is the percentage and universities that have Society of Women Engineers section, the lowest is those that go down to grade school and re-entry and junior high school programs.

DR. DANEK: Do the people who are heading these programs meet annually?

MS. DANIELS: No. And that's one of my issues and suggestions for the future.

We are trying right now at Purdue to start a network, administrators, the Women in Engineering Program.

And if you don't think the need is out there, I sent around a little five cent brochure that says, "can we talk?" and basically asked administrators of these programs, are they interested in getting together to discuss common problems?

In two weeks, I had a hundred and thirty responses back saying, "yes, yes, yes, yes,

yes." So I think the need is there.

DR. DANEK: And you're going to write to NSF for the money, right?

MS. DANIELS: I hope so.

(LAUGHTER)

MS. KEMNITZER: That's self declared too, I know that.

MS. DANIELS: I have not gotten to all the suggestions, but if I can just take a few minutes to say the last part.

The one is the networking. I think that's important --

CHAIRMAN OAXACA: You'd better take less than a few minutes, because, if you can make it very quick.

MS. DANIELS: All right. Industry changes I think is the big thing. As Jane Kahle mentioned, some of the changes that need to be made, to make science and engineering more appealing to women students. It is not appealing the way it exists now, careers are not appealing to them.

And I think the teacher-counselor awareness is another area we really need to work on. And teacher-education programs, but also an awareness type program after they've become practicing teachers.

I'll stop now.

CHAIRMAN OAXACA: Thank you very much.

Questions from the task force?

MS. MALCOM: I have one quick question and that is, you raised the point saying, of you had the highest number but not the highest percentage. Who has the highest percent?

MS. DANIELS: The predominately Black colleges has the highest percentage.

MS. FREEMAN: The total family of HBCUs you're saying.

MS. DANIELS: Specific ones. We're that data right now. We've just been funded from AT&T to look at who has high percentages of women, why is that?

And of course our intent was that

it was program and it's not, it's serendipitous kinds of things like who makes up their student population.

DR. LEBOLD: Sometimes we have special focuses.

CHAIRMAN OAXACA: Ms. Winkler?

MS. WINKLER: Can you tell of all the things you've done, what was the easiest and what was the hardest?

MS. DANIELS: Yes, I can. The easiest are the career programs for the students and their parents. And they're easy because the students are so anxious for information.

You know, they just take it up like a sponge and it's really rewarding for us putting on the program, as well as for the students.

The hardest thing was also the most disappointing to me and that's, I am a counselor by profession and we have just come up with no results, trying to talk with counselors.

I put on a wine and cheese-tasting party. What could be more, you know, accepting?

And we had three counselors attend at a state convention where there were four hundred counselors.

MS. WINKLER: Do you have a sense of why that is?

MS. DANIELS: I think that they are very unaware of technical and scientific careers and I think it frightens them.

I think their backgrounds have been so lacking in technical and scientific information that they're afraid to get involved in those areas, unfortunately.

CHAIRMAN OAXACA: I think that's a, you know, in Los Angeles, there's been, and in other areas, in particular for the Hispanics. I don't know about the Blacks or women.

But the advice you get once you do get it is terrible. You know, go into auto mechanics, you know, you're good with your hands.

MS. DANIELS: Women students that do attend, they are much more influenced by their mathematics teachers, by the chemistry teachers, than they are by other counselors.

CHAIRMAN OAXACA: Absolutely, absolutely. Thank you so much.

And once again, our apologies. We're delighted you stuck around. Hope you stay the rest of the afternoon, it's going to get good.

I'd like to ask Dr. Izaak ~~Wisrup~~ Wirszup of the Department of Mathematics, University of Chicago.

He's going to be speaking on the Soviet mathematics education and how that perhaps ties into Chicago and maybe he'll give us an insight as to why they're graduating so many engineers. Welcome.

DR. WIRSRUP: (RUSSIAN ACCENT) Thank you, Mr. Oaxaca.

Distinguished members of the task force. In December fo '79, two weeks before the Soviet invasion of Afghanistan, I sent a referral to the National Science Foundation that described for the first time the Soviet challenge in science, technology and the engineering formulas presenting statistical data in detail of the education, mobilization the Soviets undertook in '66, 1966.

This referral became a key factor in President Carter's order of February, '80 to NSF and the Department of Education for a review of our science and engineering educational policies.

The resulting study, science and engineering education for the 80's and beyond, published in 1980 corroborated my findings; to understand the educational situation of women, minorities and the handicapped and find ways to raising their level of participation in science and technology, we must first analyze the educational standards of the American population as a whole.

In my testimony today, I propose to concentrate on education and training, especially in mathematics and science, the cornerstone of technology.

I will also -- some exemplary

programs which promote the aims of the task force, in particular the Abacus funds of University of Chicago School of Mathematics Project.

The United States is now facing one of the sternest challenges in its history. On the one hand, the U.S. is still acknowledged as a world leader in science and technology. We are a nation with scientific elite and for the past fifty years been in the forefront of research and discovery.

It's major universities and training program are are magnet for student scholars and scientists from around the world.

Nevertheless, American elementary and secondary education, especially in the areas of science and mathematics is serious deficient.

While we can take pride in the achievements of a small but superb group of top level scientists and engineers, we must acknowledge that this pre-eminence has been avoiding (sic) over the past twenty years and that most of our population is scientifically illiterate.

Fortunately, awareness has already inspired a number of grass roots movements involving parents, teachers and leaders of industry and government. We are not witnessing a period of increased hope and expectations on the part of the American population.

To make an objective evaluation of American secondary schooling without first to compare it with the educational systems of Japan, America's foremost industrial and technological competitor and the Soviet, the other super power and America's strategic adversary.

The Soviet Union was the first country to introduce compulsory secondary schooling in '75. Although the graduation rate at the beginning of the Stalin era was only five percent, today almost all young people, over 99%, complete secondary general education schools or -- secondary technical vocational schools or technical schools.

The current secondary school

graduation rate in Japan is 94% and in the United States, only 75. Even more telling than these general statistics are comparisons of programs and enrollments in specific subject areas.

The great majority of American students still what is essentially arithmetic for nine years. In almost all other industrialized countries, children complete arithmetic is six years.

In the USSR, arithmetic, in combination with intuitive geometry is start in the first five years.

Comparisons in geometry are even more disturbing. Only half our students take, ever take any plane geometry and most of them never master it. In contrast, Soviet students study geometry continuously over a ten-year span.

America's secondary school physics, another building block of science, education and technical training and one which rests internal and basic algebra and geometry is in extremely poor condition and must be changed radically.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
TASK FORCE ON WOMEN, MINORITIES AND THE HANDICAPPED IN SCIENCE AND TECHNOLOGY

PUBLIC HEARING

REPORT OF PROCEEDINGS of a public hearing of the Task Force on Women, Minorities and the Handicapped in Science and Technology held at the hour of 9:35 A.M. on the 29th day of October, 1987, at 300 South Wacker Drive, 35th Floor, Chicago, Illinois and presided over by MR. JAIME OAXACA AND DR. ANN REYNOLDS, CO-CHAIRMEN.

-2nd portion-

Less than one-sixth of our high school students take the packaged one-year course in this discipline. While in the USSR, all secondary school students take a compulsory five-year sequence of physics courses developed in accordance with the latest research in educational psychology.

For some sixteen thousand US school districts the total number of full-time physics teachers is eight thousand and shrinking rapidly.

The total number of physics teachers in Soviet general education, day schools alone, is one hundred twenty thousand and the USSR drains (brings) another eight and a half thousand specialized physics teachers every year; more than the total number of physics teachers we have.

In chemistry, only thirty-five percent of our high school students take a one-year course, while all Soviet students complete four years of chemistry, including a full year of organic chemistry.

In sum, the vast majority of our

high school students have not studied physics, chemistry, geography or a foreign language and have had only a modicum (sic) of mathematics.

Not only do they lack a solid foundation for further training, they cannot even apply basic mathematics and science to simple jobs.

These results in a personal tragedy of shattered hopes for countless young Americans. It is also a national tragedy for it diminishes America's overall position in the world and places a tremendous burden on the economy and society and industry, which must invest huge sums, even for -- training and on the institutions of higher learning, which must provide costly remedial courses.

While American mathematics and science education language with no major national commitment to essential reforms, how these advantage with respect to the Soviet Union may only, can only increase.

A new program brings compulsory

computer science courses to USSR sixty thousand secondary schools in grades 9 and 10.

And Gorbachev, himself, has been before in charge of the educational reform of the Soviet Union and works very hard for the -- certification and changes and improvements.

The state of college mathematics is a direct consequence of the crises in our school mathematics, which may be largely responsible for students' lack of interest in pursuing a career in the field.

In 1980, only one percent of high school seniors named mathematics as their preferred field of study in college. Two years later, that figure had dropped to .7% or seven tenths of one percent.

While the US produce twelve hundred, over twelve hundred Ph.Ds in mathematics in 1970, in 1983, the number has dropped to six hundred ninety-eight, almost half.

The number of masters degrees awarded in mathematics has also dropped by a factor of two, from five thousand six hundred and seventy to two thousand eight hundred and eighty-three.

The University of Chicago School of Mathematics Project, sponsored by the Abacus Foundation is many respects the result of my '79 US-USSR comparative studies.

In response to the growing need for a mathematically literate -- in a technological age, our project is developing a comprehensive program to help upgrade mathematics education for American students.

It modified a rare combination of talent and resources from the University of Chicago, other universities, local school systems and industry.

And I would like to emphasize that we are not working with elite schools or selected students and teachers, we are working primarily in urban schools of Chicago with disadvantaged children.

By 1989, our project plans to have

developed and tested a model school mathematics program for grades K through 12 to serve as a prototype for form in mathematics education.

Common features of the curricula developed by our project are: facilitating the teaching of geometry and algebra. Algebra is introduced informally with the teaching of arithmetic in the elementary grades, in grade 2 and 3 and so forth.

Informal geometry is integrated throughout the elementary grades. The seventh grade course, transition mathematics, is designed as a breeze between arithmetic and the formal study of geometry and algebra.

I suggest that the creation of transitional mathematics will save future millions of youngster who have wasted nine and ten and eleven years on arithmetic and are absolutely not prepared to take algebra or geometry.

Algebra and geometry are designed to be taught in the eighth and ninth grades, respectively.

Using calculators throughout the curriculum, full operation calculators with memory are used throughout grades K to 6. Scientific calculators are used beginning in grade 7.

Probably some of you have seen pictures of little kids, Black children, disadvantaged children in kindergarten and grade 1 working with calculators and micro-computers.

Abacus, the Abacus Foundation can provide you very nice journals, I've not brought anything except statements of testimony, but I will be delighted to be of any assistance and send you materials and brochures and the ones which you need.

CHAIRMAN OAXACA: Thank you.

DR. WISRUP: Teaching -- errors of mathematics, statistics and probability are taught informally in the elementary grades. Statistics and probability form an important component of the eighth grade algebra course and I focus of the eleventh grade pre-college mathematics schools.

Teach mathematics with an

application orientation. Utilizing micro-computers as an interactive tool to expand mathematics experiences beyond textbook presentations. Using accumulative review strategy to reinforce learning.

Now -- teacher preparation is often cited for the failure of past programs to reform school mathematics. Our program is designing a teacher-development program which is rather unique.

It prepares K through 3 teachers to teach a wider range of material than arithmetic and to integrate mathematics with other subjects.

It trains mathematic specialists to teach the mathematics programs in grades 4 through 6 and again those specialists are obliged, are responsible for helping and training the teachers K through 3 in their schools.

By the end of '87, an international mathematics education resource center will be established at the University of Chicago. This unique center will be accessible to mathematics educators, scholars, publishers, professional associations and government agencies.

The center will serve as a permanent exhibit clearinghouse and research facility containing a regional and translated materials in areas related to school mathematics such as curricula in various educational advanced countries, textbook methodologies and comparative achievements.

By all accounts, UCSMP is proving to be highly successful. Although initially designed to improve mathematics training in the Chicago area, the project has gained national recognition and its materials are now being used in schools around the country.

When the Abacus Foundation started the funding of the project, we expected that there will be similar projects in at least ten, twelve states around the country.

Unfortunately, this has not materialized and our project is exposed more and more to assume a national responsibility at the time when the budgets and the personnel are insufficient to do it. But we, our materials are being used in at least twenty-two other states.

Will you allow me to take a few minutes more? Then I will return --

CHAIRMAN OAXACA: One more minute, Doctor.

DR. WISRUP: Yes? Very good. A multitude of studies in the current economic reality show that America is facing a formidable challenge to its current position and future as a nation.

It is imperative that we re-establish our country's scientific and technological superiority and recover our industrial an economical vitality.

We must be able to produce goods competitive on world markets and we must again from the Soviet Union, our previous pre-eminence in space exploration.

To accomplish this, we must train superior mathematicians, scientists and engineers in numbers sufficient to hasten our technological renaissance.

We must develop a much better educated population, so that every individual is an asset to our work force and defense.

We must raise America's general level of educational achievement by 3 to 4 years, to the level already achieved by secondary school graduates in Japan, the Soviet Union, Eastern Europe and even South Korea and Taiwan. This will be an undertaking of unprecedented magnitude.

According to some estimates, by the end of the century, close to forty percent of American school children will be non-white and the work force will have a similar demographic structure.

Unfortunately the nation is not being adequately served by current efforts to increase the number of women and minorities in the science and engineering work force.

Unless these efforts are maintained where they are effective and intensified where they are not, the nation will continue to deprive itself of a vital sources of future scientists and engineers.

They have said the decline of the total number of new entrants expected between now and 1995 increasing the number, the numbers in improving the training of women, minorities and the handicapped in science and technology -- not only a question of social justice and human rights, but also a matter of national survival.

That Americans are now coming to understand the importance of education for the nation's future can be seen from inside America by public opinion on the list Louie Harris, which was published in August, '87.

Harris concludes that the overwhelming majority of American, eighty-one percent believes that only through a better education will they come to find a way to turn around what -- over the long haul.

It is evident that the policies and measures instituted to date do not begin to --

challenge the changes needed. The only answer is a federally led, I'm not saying a federally supported or funded, a federally led national mobilization for education and the coordinated mobilization in each of the states.

This will require a sustained effort by all segments of our society.

CHAIRMAN OAXACA: Can I stop you there, Doctor? We've got other --

DR. WISRUP: Yes, please do.

CHAIRMAN OAXACA: Thank you.

DR. WISRUP: Thank you very much.

CHAIRMAN OAXACA: Questions from the task force please.

MR. LAUGHTER: This is, I think appropriate at this time, the president made a speech and I'll do it very quickly.

This man's going to go on a airplane to the Soviet Union. On the way there, he's talking to this young cab driver and the cab driver said he was going to school and driving a cab on the side.

Then he said the man said to him, what are you going to study and be? He says well I don't know yet. He goes over to the Soviet Union, he gets in a cab, there's a young man, the young man's going to college. He says what are you going to be when you finish college?

The young man says, they haven't told me yet.

DR. WISRUP: You're absolutely right. It is a dictatorship and it will remain in spite of -- and other social changes, but they are our military adversary and we have to know what is going on and to know how they are doing.

For you information, the school mathematics text in mathematics and physics and chemistry produced in the Soviet Union are by far superior to what we have in the United States by far superior. There are --

DR. LAUGHTER: -- probably take this young man that's just pretty good and say, this is what you're going to do. Is that right?

DR. WISRUP: I'm not, you know, I'm

not discussing social psychology or societal psychology or control of society. I'm saying they are doing to train their population.

While in psychology in general, the United States is foremost in the world in educational psychology. The Soviet Union is ahead of everyone else. What is to be done? How children are being trained. Were there being guild by some of the highest order in the world, superior to what Japan produces.

In Japan, the results are fantastic, but it is primarily due to the type of societies they have, the responsibilities, the competitiveness and the elitism.

CHAIRMAN OAXACA: Thank you very much for your testimony.

Dr. Thomas --

DR. RIOS: You're not going to let us ask any more questions?

DR. JOSEPH: I've got a question.

CHAIRMAN OAXACA: Well, we're trying to keep, let me, Doctor?

DR. WISRUP: Yes?

CHAIRMAN OAXACA: Two short questions, because we'll never. We'll be here until nine o'clock.

DR. WISRUP: Please, I am at your disposal.

DR. JOSEPH: This may be a little bit unfair, but I'm curious because -- one of deja vu and listening to what you said as I nodded my head, thinking of the post-sputnik period and the new math and how trigonometry was introduced into the third grade, etcetera.

Is this the pendulum swung back and we need to start again in the same type of programs? Or is this something different.

I mean, it's like, you know, why can't Johnny read? And then ten years later, Johnny still can't read.

DR. WISRUP: Where, here?

DR. JOSEPH: Here.

DR. WISRUP: Here?

DR. JOSEPH: Here.

DR. WISRUP: Let me say this. In most of the countries in the world, Soviet Union, Japan and some of Western Europe, education is a continuous effort, a sustained effort.

Americans are in a hurry -- this was a school reform in mathematics, physics, biology, science, chemistry, addressed to the more able students.

It has not been designed for the population as a whole. But again, these were short-term projects which have later evaporated and publishers have taken over the ideas of -- of the school mathematic study group and the physics groups and the one, and they have watered these down continuously until very little remained.

In the Soviet Union, education is the question of military power, political influence and world domination and they continue to do it to the highest degree. short on projects

CHAIRMAN OAXACA: Thank you so much. Thank you for your testimony.

I would like to ask Dr. Thomas L.

Martin, Jr., the President Emeritus of the Illinois Institute of Technology. Welcome.

DR. MARTIN: Thank you very much.

CHAIRMAN OAXACA: You can see that it's a hot subject.

DR. MARTIN: Yes, it is and I appreciate the opportunity to be here.

My testimony is limited to a very, in fact comparatively narrow and specific part of the charge this task force, relative to science and engineering education. I am not qualified to speak on the issues confronting the handicapped.

In addition, I have only very limited experience and qualification to comment on the problems of the majority of women.

But I do have substantial experience in dealing with the problems of minorities.

Now I'm a number of assumptions in making my testimony. I am assuming that you have read or have available to you most of the data on this subject. It's a huge volume of information.

The many published reports that you will hear from or have already heard from, the many knowledgeable organizations such as the National Association of Minority Engineering Program administrators, the National Action -- for Minorities in Engineering and others.

In addition, I assume that the task force already understands that the economic security of the United States requires that the underrepresentation of minorities, women and the handicapped of engineering and science be corrected, that this is necessary to maintain national strength in the world-wide economic competition.

Finally, I assume that all of you have read "A National At Risk" and many of the resulting followup studies of which there have been many.

So I further assume that we all, collectively understand that there are some very serious problems with the primary and secondary education system of the United States.

I'm going to offer a strictly only personal observation, based on my own experience, but this experience is derived from a joint perspective, two-point perspective.

First that of an engineer with fifteen years experience and involvement at the national policy level and thirteen years as a university president, dealing with specific pre-college and college minority engineering programs.

When I was President of the Illinois Institute of Technology, a pioneer of the nation's most successful pre-college programs to recruit minorities in engineering, a program that has since served as a model for virtually all other university -- pre-college programs.

Over the past ten years, this program, which is run by a very small school, we're only about ten percent the size of Purdue in engineering, but nonetheless, we have sent fifteen hundred minority students into engineering colleges throughout the United States, about eight hundred into pre-med programs in college and about five hundred in business schools.

In fact, presently, we have had over fifteen hundred who have actually received degrees in engineering or computer science and two hundred are presently enrolled in medical schools.

Now quite a number of those students chose IIT. Over the past ten years, IIT has graduated four hundred and fifty baccalaureate minority students in engineering and computer science, about sixteen percent of our baccalaureate engineering and science production produced forty-seven masters degrees and four Ph.Ds. That's a total of five hundred and one degrees.

Now my involvement at the international level began back in about 1972 with the planning of the 1974 Symposium on Minorities in Engineering. I served three years as Chairman of the National Committee on Minorities in Engineering and the National Academy of

Engineering, Chaired the 1979 Symposium and have served on the Board of Directors of NACNEE since was reconstituted.

This experience has convinced me that there are four things that are characteristic of successful programs for minorities in engineering. I suspect that these four things will be characteristically true for handicapped and women as well, but I can't prove that.

First, the focus must be on the talented few, not the massive majority. Students capable of completing an engineering curriculum or from the intellectual cream of the crop, the comprise at best only five percent, maybe ten percent of the graduating class and that's true regardless of race, sex or handicap.

Two, this talent requires early identification. No later than the end of the tenth grade and preferably no later than the end of the eighth grade. This provides a very narrow two-year window of opportunity, a window of last opportunity to which to implement corrected actions.

Three, the measures necessary to develop this potential intellectual -- through the pre-college years must be executed outside the framework of the traditional educational system that must take place, as I indicated, no later than the last two high school years.

And four, by an overwhelming margin, the most important factor after early identification of talent in a well-designed pre-college program experience is to provide the minority student or woman or handicapped student with a university personnel office operating in local parentis (sic).

I'll comment on each of these briefly. First, compared to their immediate peers, potential engineering and science students are easily intellectually superior -- necessarily gifted and they are easily well motivated and disciplined.

Their superior potential, particularly in the case of minority students may or may not be revealed through SAT scores, grades or IQ tests.

Future engineering and science students and especially minority students should never be evaluated on purely objective criteria.

There should always be a very high degree of personal evaluation by each student, by one or more individuals who understand where the engineering or science student is coming from, as well as the rigors of the academic environment he's going into.

The critical point of getting more people into engineering and science, whether they're majority, minority, women or handicapped is the prospect for intellectually talented people to look for the few among the many and this requires a considerable investment in careful evaluation in selection processes that cannot be done by mechanical reliance on test scores for other objective measures.

Remember, the focus is upon a comparatively small number of talented students with high potential who must be handled individually.

The nature of engineering science curricula is such that students are admissible to college programs only when our high school program of study includes a very heavy and specific dose of mathematics and science.

Decisions on mathematics and science courses made by students at the beginning of their second or third year of high school determines their admissibility into a college engineering program or a decent college science program even though that occurs years later.

As a consequence, it is imperative that there be early identification for future engineering and science students and this must occur, as I indicated, no later than the third year of high school so that students with high potential can be properly counseled and guided to a -- in the proper mathematics and science courses.

Moreover, the end of the eighth

grade probably represents a convenient, useful and reasonably accurate point at which the converging factors of inherit intellectual talent and developing personality can be assessed to determine engineering and science potential.

Thus, between the end of the eighth grade and the beginning of the eleventh grade, there is this two-year window of opportunity in which positive, individual and programmatic actions can be taken to increase the number of minorities, women and the handicapped who later undertake programs in engineering and science.

It must be emphasized that this is the last window of opportunity. Students on the wrong academic path in the tenth grade are virtually unreclaimable as far as college engineering programs are involved.

And ideally identification should occur even earlier than the eighth grade, in grammar school preferably.

Now while there are many excellent school system, public and private, parochial and so on, most students, particularly minority students, attend schools in the large urban systems.

And it is these schools that are beset by the most serious of the problems, failures and deficiences that were identified in "A National At Risk."

As a result, in such schools, it is almost impossible to single out those students of high potential and give them the special attendance, guidance, motivation and remediation that they require.

Because such a program is generally not possible within such schools, it must be done outside the system. And this means that action programs will almost invariably be managed by colleges and universities, by independent organizations who lack specific purpose or by a consortium of education institutions, business and civic groups.

And if you look around the country today, you will find that all of the active minority and engineering programs fit that description.

Now the issue of a local parentis is my last point. These are very difficult times to be an adolescent making the difficult transition into adulthood.

Social change over recent years has been profound. In the years since the end of World War II, there has been an increasingly pervasive use of mind-altering drugs, a breakdown of the traditional family, solidification of the ever-increasing welfare underclass, the loss of self discipline and sense of person and social responsibility, decay of moral values, decline of religion as an important socio-cultural force and the increasing tendency to insist upon immediate self gratification and the accelerating loss of pride in craftsmanship and a job well done.

All of these factors have affected young people. With the change in the character of the family as we used to know it, may be the most serious.

Most children today are raised in families where both parents work or where there is a single parent. In either case, the benefits of parental guidance, influence, role modeling and assistance are either lacking or at minimal -- to traditional norms.

The transition from high school to the college environment is difficult for most young people. Lack of supervision, the need to make important decisions on their own, a new and often confusing environment, new faces, new rules, all make the transition from adolescence a very tough task while they're simultaneously confronting a whole new set of studies.

When the field of study is engineering, the transition can be even more traumatic because of the high level of program difficulty and the high level of intellectual achievement characteristic of the other students, which generates an intensity of competition that is new to practically all of these students who are accustomed to being number one in high school and now are fighting just to be average in their engineering program in college.

And then there are high expectations that the faculty have to exercise self discipline and independence of study.

All of these programs are immensely magnified for the minority, handicapped or female student, because the strangeness, competitiveness, whiteness and maleness of the environment, and this can be hostile and it can be intimidating.

These students need the closest thing to the traditional parent on the scene; someone to talk to, to listen to, to stand up for them, to encourage them, to understand their individual problem, to help them work them out.

And colleges used to do that. But the concept of a local parentis was thrown out during the student riots of the 1960s. I think it needs to come back for all students. I think it's absolutely essential that it be provided for minorities, probably for women and for handicapped students as well.

If we do not do that, then the dropout rate and the failure rates will continue will continue to be unnecessarily high.

In closing, I'd just like to summarize the four things that my almost seventeen or eighteen years of experience with a substantial number of minority programs locally and nationwide have told me that are important.

First, concentration on the talented few. Two, seek early identification with that talent. Three, undertake corrective actions outside the existing educational system. And four, re-instate the concept of a local parentis in colleges.

Finally, perhaps in the end this is where we fail the most, commitment to increasing representation of minorities, women and the handicapped in engineering and science must be firmly and publicly embraced by the top leadership of every education, business and government activity.

And except for a very few notable

exceptions, the absence of entities of the federal government in this respect has been a national embarrassment.

I thank you very much.

CHAIRMAN OAXACA: Thank you. Ms. Winkler?

MS. WINKLER: We seem to have two threads kind of developing here and I wanted to kind of pursue and clarify them a little bit if we could.

One seems to speak to a need for drastic improvements throughout the whole school. And the other seems to be looking at the elite, the most gifted, the most talented. And you clearly seem to be coming out on the second; speaking I guess from your experience in working with these students.

Have you thought about the implications and could you talk a little bit for a whole school system, if the most talented are pulled out into programs sponsored, as you said, by business and other, and universities.

What would you propose, particularly for late bloomers, who may remain within the normal public school system, I'm just, implications of it are hard for me to imagine.

DR. MARTIN: Sure. I understand what you're saying. I do not, I am not against one and for the other. I am for increasing the quality of math and science education for the whole population.

We need better scientists, better engineers, better technicians, an informed population and a voting population. We need all of that.

Dr. Wisrup is precisely correct on that point, but the charge to this task force, as I understood it, was to get minorities into science and engineering -- women and the handicapped.

When you're talking science and engineering, as a career, which is what I understood to be the charge, perhaps incorrectly, you're talking college programs.

And when you're talking about that, you're talking about a very narrow slice of the high school graduating class.

MS. WINKLER: Is that because of their basic ability? Or is it because our school systems are unable to produce --

DR. MARTIN: It's all of the above. The answer is yes. It's talent, intellectually, it's availability. As Dr. Wisrup indicated, there's just not enough teachers. In the City of Chicago, there's one physics teacher for every two high schools and half of those are physical education graduates.

I mean, it's a sad situation. So part of it is lack of opportunity, a lot of it is lack of motivation, some of it is lack of ability. I mean, it takes a certain type of mind, not necessarily a better one, to have a mathematical, science orientation. They are just different kinds of people.

CHAIRMAN OAXACA: Dr. Malcom?

DR. MALCOM: I wanted to find out

from you how much of the success of your program do you think is due to the acquisition of a critical mass of students?

The isolation factors, I know, have been just deadly with regard to very able minority students who have gone on to, especially majority campuses.

And I was wondering your perceptions on that?

DR. MARTIN: Well, as some of you may know, the person who led our program for years is Nate Thomas and Nate was the parentis in local at IIT.

(LAUGHTER)

DR. MALCOM: The local parentis?

DR. MARTIN: Fantastic. And early on this notion of having a community was recognized at IIT.

And our Black students, in particular, were early pioneers in developing that. We are fortunate in the sense that the campus is on the southside of Chicago, which is an almost entirely Black community, certainly overwhelmingly Black.

So it is our home, even though the campus itself is predominantly majority White, we have had a long history of very good interracial relations on campus.

I can see that a Black student, for example, going to a small town where a college was, where there wasn't much of a minority population and having problems.

But on our campus, it never was a problem. All of the fraternities are interracial. We have no problems like that.

CHAIRMAN OAXACA: Thank you so much, Doctor.

I'd like to ask Dr. Yvonne Walker-Taylor, who is President of Wilberforce University, she has to catch an airplane and Mr. Thomas Kucera, who was scheduled before has been gracious enough to let Dr. Taylor move forward.

DR. TAYLOR: Thank you. And thank you Mr. Kucera for relinquishing your time. Your airport is so complicated, I need an hour to get to my gate.

(LAUGHTER)

DR. TAYLOR: Chairman and members of the Task Force on Women, Minorities and the Handicapped in Science and Technology, I come from the oldest predominantly Black institution in America, one hundred and thirty-two year old Wilberforce University and it's founded for and by Blacks.

Industries, government, organizations and universities have experienced a common problem of attracting and recruiting qualified, non-traditional employees, women and Blacks into engineering positions.

In this regard, special concern and efforts have been underway at Wilberforce University for the past ten to fifteen years, directed toward increasing the available pool of qualified minority and women engineering graduates.

The dual degree engineering program

provides three years of general and pre-engineering studies at Wilberforce University and two years of engineering studies at the University of Dayton.

Our programs emphasizes the acquisition of a sound knowledge, based in mathematics, chemistry, physics and comprehensive sciences, all of which are essential prerequisites for success in engineering.

As a result, the probability of success during the last two years of study are greater for the dual degree student because of the support services and skills developed by virtue of attending Wilberforce.

Wilberforce has a mandatory cooperative education program, which provides meaningful work experience for all students. Most engineering students do three to four coops during the five-year period.

In spite of this, the dropout rate of the first two years, for the first two years is extremely high, because of limited financial resources.

The necessity of scholarship support is imperative if the university is to continue to deliver a high quality educational product. Currently, students pay 69% over the course of attending Wilberforce, however, that amount approximately 90% come from federal and state support.

Grant assistance from Basic Educational Opportunity Grants and Supplemental Educational Opportunity Grants, couple with the now Perkin's loans and so on are sometimes insufficient to meet the students' needs.

Further complicating our ability to serve these students financially is a decrease in government support to educational programs, particularly financial aid.

As it stands, federal and state support, along with the university's scholarship program, are the primary sources of assistance in supplementing the students' resources.

The economic viability of the

engineering degree is demonstrated by the fact that today's graduates with baccalaureate degrees in engineering are receiving average salary offers upwards of twenty-six thousand dollars ($26,000).

The predicted demand for engineers does not show any weakening of this salary level for the foreseeable future.

For the pool of students, for the pool of students from which we draw, where average family incomes are under twelve thousand dollars ($12,000) per year, completion of this program provides a dramatic step up the economic ladder.

It is a long and demanding five years from entering an engineering program to becoming a part of the available pool of graduates.

Beginning with a number of students in 1973, in the last fourteen years, only thirty-one of our students have graduated with a Bachelor of Science degree of engineering from the University of Dayton with concomittant Bachelor of Science in mathematics or comprehensive science from Wilberforce.

We have sixty-one students now enrolled in an engineering program and nineteen students enrolled in our dual degree program in computer science.

Of these totals, forty-two are male, thirty-eight are women.

We have twenty-three enrolled as freshman, thirty-three as sophomores and twenty-four juniors.

On women, while a few women have always entered the engineering profession, it has only been recently that national attention has focused on the shortage and need for women engineers.

The United States Bureau of Labor Statistics indicated in 1972 that two-thirds of the four and one-third million professionally employed women were concentrated in five professions; teaching, nursing, social work, library science and library work and dietetics.

In other words, fewer than one

percent of the thirty-one million women workers fill professional positions, which are non-traditional for women such as law, engineering, medicine, etcetera.

The data for women entering the engineering profession coincide exactly with their national statistics.

In 1971, only four hundred and three of the forty-nine thousand nine hundred and fifty-four engineering graduates were women.

The most recent data available, while indicative of progress, still leaves little doubt that engineering is a profession, as a profession is still considered non-traditional for women.

Wilberforce now has twelve females and eight males attending the University of Dayton. Of these seventeen major -- seventeen are majoring in engineering and three in the new computer science program, from which we have no graduates because is simply the beginning of the new program; it's only three years old.

The fact that the engineering profession needs women is undeniable. The engineering profession needs the input of women to provide the broadest possible base for new and creative ideas necessary to meet the challenge of our technological society.

More basically, women exclusively use many products which have for the most part been designed by men.

It comes to mind to me that awful seatbelt that we have to use and if women had designed it, it would not ladies hurt the way it does.

(LAUGHTER)

DR. TAYLOR: It would seem reasonable that women engineers could provide valuable input to the design of such products and indeed through all aspects of our technological society.

In view of this shortage and need for women engineers, special efforts must be made to break psychological barriers and interest high school girls in selecting engineering as a career.

Simultaneously, work opportunities and scholarship funds must continue to be provided so that it is financially feasible for women to pursue and engineering education.

Conclusion? All of our thirty-one graduates are currently employed as engineers. Many by the firms where they co-oped as students.

Twenty percent of these students had grade point averages of B for the last two years in engineering subjects at the University of Dayton. Twenty are male, eleven are female, three graduated in civil engineering, nine in chemical, six in mechanical and thirteen in electrical engineering.

In view of this severe underrepresentation of women and Blacks in the field of engineering, every available source with requisite capability must be tapped in the attempt to begin to rectify the situation.

We, at Wilberforce, have demonstrated the capability to meet this challenge. With additional financial resources, we can guarantee tripling or quadrupling our per anum output of engineering graduates without any sacrifice to program quality.

Thank you very much.

CHAIRMAN OAXACA: Thank you very much, Dr. Taylor. Questions from the --

MR. SCURRY: Dr. Taylor, I want to just clarify something in my mind that you said in reference to the dropout rate during the first and second years.

Is it my understanding that you lose more people because they cannot pay to stay, as opposed to academic deficiency?

DR. TAYLOR: Precisely, yes. You know, this thing could go on. I listened to the last gentlemen, Professor Martin, I got all fired up. I said "Wow, if I had heard him before I wrote this, I would come from a different angle."

But we have open policy at Wilberforce University. We take them as they are, where they are. And if they come in saying they want to major in engineering and they can't add two and two, we say, "All right, give it a try."

And you'd be surprised what happens to some of those kids. After they get past the Math 100, we used to tell them, "If you flunk Math 100," which is plain arithmetic, "Forget it."

But we have discovered that it is not so; that frequently the youngsters have not been highly motivated when the mathematics was offered to them.

Now that they see this as a possibility, they throw themselves full force into it and we are parentis local and all that, whatever you want to call us, that's what we are.

We are small and we take special pains with our students. Our engineering student classes do not exceed fifteen, which gives the faculty member an opportunity to know every hair on his head between the three years that they have with us, between the time they come and the three years that they leave Wilberforce.

DR. HAINE When they drop out, do

they go to other programs or do they --

DR. TAYLOR: No, this is dropping out of school. They do not drop out of the program itself, well some do, but the ratio is small. Those who drop out from the program sometimes are able to return to the school, but not to that program because it is a five-year program and they need to get out immediately and our co-operative education capability gives them an opportunity to experience a job.

And they see that job and they go for that, rather than the five years.

CHAIRMAN OAXACA: Ms. Freeman?

MS. FREEMAN: Do you think that your joint program with the University of Dayton provides advantages in terms of lowering the psychological or cultural trauma that one, that a Black might incur in other, going to an all-White, a large university, for example.

Or what are the other advantages that might --

DR. TAYLOR: Well, to speak to that

one, it's still a cultural shock for the student to go to UD, but we prepare him or her for that shock.

There's a cultural shock in going into, from the protected atmosphere of the predominantly Black school into the big city of Dayton. We're in the country, our student body is eight hundred, plus one hundred on co-op during any given trimester.

And the shock of going into the larger university is sometimes, at the beginning, was very, very severe for our students.

Now that we have that many students over there, they have found that they formulate their own study groups now. They are no longer dependent upon the White kids to let them in, as they were during the beginning of the program.

The beginning of the program was almost disastrous for students. They came back, they were upset, they had encountered prejudice, not just racial prejudice, but intellectual prejudice, which is a part of racial prejudice as well, because my face is Black I cannot be an engineer.

And there was that attitude of somebody old turk -- ah, people who were --

(LAUGHTER)

DR. TAYLOR: (continuing) -- the professors of engineering, with all due respect and they felt that a Black kid had no right to even attempt to get into that elitist society of engineers, to say nothing of women.

And I just listen to what's happened to women and I know what, oh, do I ever know. And being Black and women is double jeopardy and going into an engineering program is triple.

And to have as many graduates as we have, I think is remarkable.

Yes, sir?

MR. LAUGHTER: Don't you think the, excuse me, the area you wish to take out from the and --

DR. TAYLOR: And you know what I'm

talking about too.

MR. LAUGHTER: (continuing) -- I'm glad to hear you say, that's Big D to me --

(LAUGHTER)

MR. LAUGHTER: But I think there are some new thinking at the University of Dayton. I'm not trying to protect them or anything. I think with Tom Ferricks (ph) in there, I think that you're getting a lot, it was a Catholic school and they were very, very conservative.

And so, I think that was a problem. But too, I think to your advantage too is the new facilities, I think NCR, didn't they give --

DR. TAYLOR: Yes, NCR has been good to both of us.

MR. LAUGHTER: Computers and --

DR. TAYLOR: Yes. We have computers from --

MR. LAUGHTER: I think that, you know, I think that happened probably and I'm not trying to protect the University of Dayton, but I think it happened at most schools.

When the Blacks first started to come, there was a probably resentment, but I think that they, I hope today they would treat you fair and square and I hope that it'll go for years to come.

And I've been to Wilberforce and it's a, you're doing a great job and the Dayton community thinks a lot of it.

DR. TAYLOR: Thank you. We pray to that end too.

MR. LAUGHTER: You know who took me there the first time was Branch Rickey, when he --

DR. TAYLOR: Oh yes, when he got his degree. Yes, I'll never forget Branch Rickey, yes.

MS. FREEMAN: Do you think that the joint school program is worthy of expansion to the other HCBUs, the concept that is of joining up with --

DR. TAYLOR: Indeed so. We really copied our program after the program in Atlanta between the university there, the Black university, the five and the University of Georgia.

We went down there to find out what mistakes they had made so wouldn't, we could make our own and not make theirs.

(LAUGHTER)

DR. TAYLOR: But it, it is a good thing that you do because you see you have the credibility of the White school; that satisfies the White people and then you have the realism of the Black school, which supports the students who come to the Black school and that is a good mesh.

CHAIRMAN OAXACA: Mr. Fernandez?

MR. FERNANDEZ: Have you looked or talked to anybody either in the, within your own state or other states where there would be a possibility of taking your co-op program with Dayton as a model and extend it to state schools?

Throughout the United States, every state has big schools and small schools and the environment that you're talking about, small racial -- the teacher were faculty is very good and very much needed, especially for minorities.

Could that be translated to state schools?

DR. TAYLOR: It would be rather difficult. We have tried some programs with state schools, namely Central State, which used to be Wilberforce and -- the mother is Wilberforce.

And going through all of the trauma you have to go through to get anything done in the state, by the time we get it done, I mean all of the kids will be old and --

(LAUGHTER)

DR. TAYLOR: So we are expanding the program to the United Negro College Fund, which has forty-three schools that are commensurate with the type school that Wilberforce is and we are an accredited school.

And some of the schools have adopted the mandatory cooperative education program. And that, in itself, I think for us, you're asking what the pluses are. I think that one is an immediate plus, because we have no problem placing our students.

We would like to join up with the state if you could find an easier way to get to through the bureaucracy.

CHAIRMAN OAXACA: Thank you very much, Dr. Taylor.

MR. LAUGHTER: Excuse me, the University of Dayton, I'm not too much on -- but the University of Dayton is a private Catholic school --

DR. TAYLOR: Yes.

MR. LAUGHTER: (continuing) -- of probably only fifty-two hundred, wouldn't you say?

DR. TAYLOR: About that, yes.

MR. LAUGHTER: And I'm sure, you know, they can really get things done a lot faster than the state's -- I'm a product of parochial schools, but in the State of New Mexico, where I come from, there are smaller, predominantly minority schools that were trying to set up such a network --

CHAIRMAN OAXACA: Dr. Taylor, I thank you. I have no doubt that the plane would not dare leave without you.

(LAUGHTER)

DR. TAYLOR: If I can just find it.

(LAUGHTER)

DR. TAYLOR: Thank you.

CHAIRMAN OAXACA: You got a hard act to follow there Mr. Kucera.

MR. KUCERA: I believe I do.

CHAIRMAN OAXACA: Let me welcome you. The area of the handicapped has been one that we have significantly noticed, is not treated. And we hope by the action of the task force that we go a long way towards changing that.

We thank you for being here.

MR. KUCERA: Well, of course, my perspective is a little narrow because I'm mainly concerned with chemistry, chemists and, but I'm sure that some of the things we suggest might have application and be of assistance to the handicapped in science and technology.

I didn't mind waiting because I see that both people from IIT and Purdue preceded me. It's good to know that where I got my degrees is well represented.

(LAUGHTER)

MR. KUCERA: The status of women, minorities and the handicapped in chemistry have been and is a concern of the American Chemical Society.

There has been significant progress in the number of women who are members of the ACS to the present. Fifty percent of the members are women.

Over the past few years, the percentage of women in membership has been increasing at the rate of one percent a year and now for member chemists under thirty-five, one third are women.

On the other hand, the percentage of Black ACS members has remained relatively steady at two or three percent.

The ACS has a Project SEED there's

a program that introduced economically disadvantaged high school students mostly from minority groups for summer employment in an industrial chemical setting.

SEED is supported by voluntary contributions from the chemical community, although it did receive an NSF grant early on.

Important as the role of the ACS is in helping women and minorities to make chemistry their careers, I'm not here to represent the ACS on these efforts.

Rather, as Chairman of the ACS Committee on the Handicapped for the past eight years, I come here to relate the work of the committee and the status and the problems of the handicapped in chemistry.

The mission of the ACS Committee on the Handicapped is to make education and employment in chemical sciences as accessible to physically handicapped persons as those available to able bodied.

The goals of the committee are to

make all programs and activities of the ACS available and accessible to disabled individuals.

To aid in the removal of existing barriers, both physical and attitudinal to the educational and full employment of handicapped individuals, and to facilitate the involvement of disabled chemists in the chemical profession and the activities of the American Chemical Society in advising and recommending to other ACS committees and staff on matters that involve the handicapped.

And to help to prevent the creation of additional barriers. Presently the Committee has about six hundred self-identified handicapped chemists, chemical engineers in the computer file.

Assuming there is at least as many that have not identified themselves, the handicapped comprise a small minority within the ACS membership. Only a half to one percent of a hundred and thirty thousand members or three-tenths to six-tenths of a percent of the chemists, if you use the data and the latest NSF report.

Compared to almost two and a half percent of all scientists and engineers that report a physical handicap in 1982, the handicapped are markedly underrepresented in chemistry and chemical engineering.

One of the main reasons for the low number of handicapped chemists was the barriers that denied full access of young people to the kind of education that would permit them to follow careers in the chemical sciences.

These attitudinal barriers were particularly high for courses that involve the chemistry laboratory, as most chemistry courses do. One of the first activities of the committee was the development of a manual, "Teaching Chemistry To Physically Handicapped Students."

This manual resulted from a 1980 workshop held by the ACS and sponsored by NSF. In turn, the workshop was recommended at a conference in 1978 on barriers to post-secondary science education for handicapped students, organized by the Triple AS, again sponsored by the NSF.

The manual now is in its second edition has been distributed to sixty-eight hundred chemistry teachers, counselors, chemistry departments and high schools, colleges and universities in the U.S., Canada and Europe.

There is a considerable interest in teaching chemistry to handicapped students in Japan and the manual was translated into Japanese for use in high schools and colleges.

It has been the experience of many handicapped chemists, including members of the committee that attitudinal barriers at secondary and college teaching levels did prevent many interested and talented handicapped students from any meaningful exposure to chemistry or physical science in the laboratory.

How many potentially good chemists were shunned away from an education and a career in chemistry, we'll never know. But we can anticipate an increased number of handicapped students seeking associate, bachelor and advanced degrees in chemistry as a result of such efforts by the ACS, Triple AS and of course the increase of educational opportunities due to Section 504 of the Rehabilitation Act of 1973.

While the educational aspect is central to allowing the handicapped access to the chemical profession, the committee is very much concerned with the handicapped chemist doing community -- chemistry beyond academia.

In particular, there was a concern with both access and effective communication at national, regional and local section of meetings of the ACS.

For example, wheelchair access is now considered in selecting meeting all over the country. And interpreters are arranged for deaf chemists at any meeting sessions they may wish to attend.

Based on reports from hearing-impaired chemists and much of what is being said in technical sessions at ACS meetings is not heard by them, the ACS meeting and expositions committee and departments are considering providing assistive listening devices.

As there are about five times as many hearing-impaired as compared to the deaf, provision of these devices at scientific meetings will greatly aid the effectiveness of communication and benefit all by allowing fuller participation of all attendees.

Some industrial concerns have installed hearing assisted setups for their internal meetings, but at programs to promote such needed help in academic and government institutions and by scientific and engineering associations will clearly benefit the hearing impaired during their education, but it is particularly beneficial in the years of professional employment as the number of hearing-impaired does increase.

Unfortunately, the attitudinal barriers encountered and overcome by a degree of handicapped chemists during his or her education -- after graduation.

In the present tight labor market,

a handicapped chemist with only academic qualifications however good but with no experience in the workplace often does not find an open door to become, as President Reagan said of Tuskegee, part of the great technological and scientific changes now sweeping our country and the world.

Some employers are very much aware of the contributions that can be made and have been made by physically disabled scientists and engineers and do hire them.

But many employers are reluctant to hire anyone without job experience, especially if they have a physical handicap as well.

The Handicapped Internship Program at Argonne, which was mentioned by Dr. Springer this morning, I hope he mentioned it anyway, is designed to provide practical work experience to qualified, degreed, handicapped scientists and engineers.

Such an internship program is not only a means for the handicapped chemist to contribute to the work of the laboratory, but allows the development of a job history, furtherance of an on-going career in a chosen field.

The Internship Program at Argonne should certainly serve as an example for other national laboratories of government, laboratories at all levels and perhaps for work done in the private sector and government grants.

The Internship Program should be developed for all the physical science and engineering, not just chemistry and chemical engineering.

The programs in the related chemical areas are for environmental, material and health sciences would open more opportunities for handicapped chemists and meet more rapidly growing sectors of the chemical community.

There must be many more programs that could assist handicapped chemists in following his profession. For example, the procedure for awarding grants by the NIH does consider women, minorities and the handicapped.

However, the small business grants administered to the NIH do not, do consider women and minorities, but not the handicapped minority.

This could not be the intent of Congress, as the employment of handicapped scientists and engineers is as urgent as for the women and other minorities.

The development of a long-range plan to advance opportunities for women, minorities and disabled persons in chemistry and indeed in the physical sciences must take an account of the present employment situation.

Major restructuring of the chemical industry due to, among other things, to acquisitions, mergers and takeovers, has resulted in an increasing number of multiple terminations over the past two years.

Over two-thirds of the employed chemists work in industry, primarily in R&D laboratory work and management and these terminations include a significant number of essentially involuntary early retirements.

These terminations are not only a very real problem for the older, but maybe not so old chemists who finds him or herself to be virtually unemployed or at best underemployed, but representing the loss of a valuable human resource of technological enterprise of this country.

The ACS Committee on Professional Relations who monitors these multiple terminations is also active in investigating the problems of experienced chemists, which means older chemists, who are increasingly affected by these career-shortening events.

Some of these early retirements actually have opened up jobs for entry-level chemists, but the overall employment rate is low at about four percent a year.

There is no evidence from our surveys that women, minorities and handicapped are being spared in these forced career adjustments.

The perception may well be that they may fare worse than others and that a hard won career may be critically shortened.

This may be a misconception, but it would be a pity if it deterred capable and talented persons pursuing a life's work in science and technology.

This problem is even more acute for handicapped chemists, because there are more of them, as more of them become handicapped during the course of their employment.

On the longer term, this means that older chemists, that is older chemists retire there will be fewer experienced chemists to replace them.

The need to attract those interested an capable in science and technology, including women, minorities and the the handicapped, is necessary and vital to become a competitor in the changing technological times ahead.

CHAIRMAN OAXACA: Thank you so much.

Ms. Winkler?

MS. WINKLER: If you could think of

two or three things which are the biggest barriers for a kid who wants, who is handicapped in some way wants to be a chemist, what would you, and the real practical things that get in the way, what would you say they are?

MS. KUCERA: Well, the biggest one is, I hope I made clear are attitudinal ones on the part of the, particularly the chemistry teachers.

I'm a chemist and I'm a chemical teacher, but some of them are just against having handicapped people in the laboratory. Some of the reasons they give are for safety, although there's no evidence that they are less safe in the laboratory.

In fact, the evidence is to the contrary because they have to plan ahead sometimes, particularly orthopedic, that they attempt to be very careful in what they do and allow for mishaps and what have you.

But some of them are just, just convinced that there is not a career, that it is not possible for a handicapped, say chemist or physicist, what have you, when they do get through school. So they try to dissuade them early on from getting on track for such a professional career.

It's largely attitudinal I'd say. There are actually physical things. We do have to work on that, but I didn't go into it because they tend to solve themselves.

The students and their teachers, if they do encounter a physical problem, a physical barrier of some sort, those are relatively easily remedied and really with very little cost. In fact, a lot less cost than providing other things for all the students. It's usually, it's mostly attitudinal, not physical.

CHAIRMAN OAXACA: Dr. Malcom?

DR. MALCOM: I was going to say that within the time that I have been at the Triple AS office, we have actually had instances of students and/or their parents calling and said that they had been denied access to chemistry, to a chemistry course; that they had an interest in chemistry; that they wanted to take chemistry and that they were refused entry into chemistry courses by either the principal and/or the teacher.

MR. KUCERA: And the Triple AS calls us then.

(LAUGHTER)

MR. KUCERA: And we have in a few cases sent chemists over, both as role models and people can persuade the teacher that he doesn't know what he's talking about and the fact of the matter is that -- one of the problems is that there are schools that have no problem whatsoever because they've had experience.

It's most of the time, but not all the time it's because the teachers have not had experience with handicapped students and they are sort of afraid of the situation or just don't want to get involved.

But once they have them, I'd say the response has been very good; that from then on, they're welcome because they are considered part of their good, their teaching techniques, teaching ability, to be able to satisfactory teach the handicapped.

CHAIRMAN OAXACA: Dr. Scadden?

DR. SCADDEN: I'd just like for clarification on career -- you indicated that because of the mergers and so forth there were some mass termination of positions.

Is this something that you would indicate that would be changing; that there will be ample positions in the future as part of a growing demand for chemists?

DR. KUCERA: Well, there is many studies, including as I say, I've been a chemist now for forty-two years and this, it goes up and down; that the real problem, I think, is that there are periods due to many, many factors where the employment market is very tight and then when the students have already started to shy away from it, then it gets, and the number of graduates drop, along comes the need for them and they don't provide, they don't provide, they're not there for the job.

Admittedly, chemistry, for one, has a rather slow growth rate because it is a very large body, but it's going to be, it's not an answer, for example, as fast as computers and other things.

That's way I mentioned in chemistry there are areas of physical science where chemists are heavily involved; that the, more and more people going into them and offer a good job opportunity and a clear opportunity for those who do come through, able-bodied or not.

CHAIRMAN OAXACA: Mr. Kucera, what would you suggest to the task force for broadening the pool of young people, say at the high school level so that the, that programs are implemented so that when they get into college they have a better chance of success and to some degree the issue that you've just finished talking about have been addressed to make it.

They've got enough problems in getting right through the curriculum without having to put up with all these problems that you describe.

What would you suggest to this task force might be a mechanism that we should suggest as part of our report.

MR. KUCERA: Well, I'm not sure I understand your question.

The problem is how to get these talented or would-be ones that Dr. Martin mentioned, the few percent could be identified and have talent or are gifted, but are also handicapped.

I think for the most part, it has to be working on this attitudinal barrier. And of course we have, I don't want to go into all the things, but chemistry teachers like chemists themselves are great on association and they have had many, many meetings on the state level and the national level and the city level on promoting chemistry education and particularly one of the topics that is perennial is the education of handicapped students and how to properly treat -- and get them through.

Now is that really responsive to your question?

CHAIRMAN OAXACA: Yes. Attitudinal barriers.

DR. KUCERA: Yes. It's attitudinal. The physical is trivial compared to the attitudinal.

CHAIRMAN OAXACA: Dr. Danek?

DR. DANEK: I have a related question. It's personal in a sense and I hope people don't mind my taking the time.

It relates to our agency, the National Science Foundation. What have we done in the past? What are we doing now? What are we not doing? What would you like to see us do?

DR. KUCERA: As I acknowledged that you have been very helpful and we have had seed money for SEED. We've had grants for our programs for the handicapped and we have people on our committee who are from NSF, they have, they are chemists and they are also handicapped and they are also working for the NSF.

And I think that we keep on going back. We hope to go back as problems come up or solutions perhaps that we would like to try and go to NSF for support and we have.

And of course, we don't do it lightly, we want to make sure we at least have a good program that might be beneficial -- chance of course it may not be as beneficial as we would like, but then we go to NSF.

And I must say, I don't know that the NSF, this -- period of time has really been a problem. I mean it may be, but we haven't really encountered it.

We don't get money for everything we ask for, but we, well, but we get money for -- we're supported primarily by the ACS itself.

The American Chemical Society are the member supported dues. This is one of their activities that they support and we could use --

DR. DANEK: We have no targeted programs for handicapped. Would you like to see some?

DR. KUCERA: Yes, I very much would.

DR. DANEK: What sorts of programs would you like to see, I mean, specifically?

DR. KUCERA: Well --

DR. DANEK: Attitudinal or--

DR. KUCERA: Well, mostly attitudinal, although you must remember when we say physically handicapped we have a variety of handicaps.

I mean, well, there are three major categories which are -- one is orthopedically, the other one of course is deaf chemists, which I did -- because they are the ones that have the least problem, although they do run into some real ones as time goes on.

And of course the other one, our blind chemists and we have a problem there because I have heard many people consider a blind chemist as a oxymoron; it's like an inexpensive lawyer or something. It just really doesn't go together.

(LAUGHTER)

DR. KUCERA: However, we do have, we do have, we do have, for example, forty known blind chemists in the ACS and we have a couple or three, we've had about four blind chemists on our committee.

And some were at graduate school, some were out working and most of them went through with their education when they were blind.

So it's not, they have very special problems, again it's mostly attitudinal because they can, in the laboratory with computers and with special assistant devices which we also sponsored too, we have supported them on those.

They can do a credible job commensurate with their talent and their education.

CHAIRMAN OAXACA: Thank you so much Mr. Kucera.

We'll take a five-minute break and be back on schedule at 3:30.

We're going to be trying to wrap it up by 5:00.

(BREAK)

CHAIRMAN OAXACA: We are continuing the testimony.

I would like to ask Dr. Marion Thurnauer, President and Patricia Finn, member of the Chicago Chapter of the American Women in Science and we welcome to this afternoon's session and thank you for taking the time to testify.

I might remind you it's going to get close. We're trying to get everybody out of here to catch flights by 4:45, so when the bell rings you got sixty seconds.

We're going to get meaner as the evening wears on or we're all going to miss our flights.

DR. THURNAUER: As you said, I've come to testify on behalf of the Chicago Area Chapter of the Association for Women in Science, also known as AWIS.

The Chicago Chapter of AWIS was founded in 1978 for the purpose of promoting equal opportunities for women to enter the scientific professions and to achieve their career goals.

Included in the goals of the chapter are:

To encourage young girls to seek careers in science and mathematics.

To support women in achieving professional advancement.

Assist women seeking to re-enter scientific employment.

Recognize the achievements of women in science and to inform the public concerning women's roles in the scientific community.

It is not our purpose in this testimony to read or evaluate statistics on the number of women in science. There are numerous studies available which tell the trends.

Although there have been some improvements in recent years in the numbers of women entering scientific fields and of women employed in these fields, women are still underrepresented in science and technology.

The numbers of women in science

will have to increase more rapidly before any real progress will be noticeable and self perpetuating.

Our purpose then is to tell you about the programs that we have organized which have been designed specifically to provide career counseling to young women, encourage young women to stay in science and educate the general community.

Based on our experience then in these areas, we recommend possible programs which could be implemented to increase the number of women in science and technology.

Although we are most familiar with the problem of underrepresentation of women in science, most of what we have to say can also be applied to the minorities and the handicapped.

In our written testimony, we describe our activities. These include presenting awards to encourage young women students, a speaker's bureau whereby we go to local schools and talk about our careers and we have submitted the printed programs of three workshops in which we were involved.

They were each aimed at a different group. In one case, teachers and counselors; the second case, junior high and high school students and in the third case, college students.

All three were very successful as judged by the enthusiastic responses they received. A byproduct of our workshops held in '82 and '84 was a bibliography of career pamphlets.

We in the national AWIS office still receive many requests for this booklet, mostly from teachers, although just sitting back here I talked to Ms. Larsen from 3M who testified this morning and she said that they also use our booklet quite a bit.

All our activities that we describe we carried out by a few dedicated and hard-working women. These activities were undertaken in their spare time, which I, they quote and in several cases there was first the difficult task of obtaining appropriate funds.

Obviously, we believe that these programs are valuable encouragement for women in science. The workshops have been particularly rewarding.

Probably the most important function of a Women In Science Career Workshop is the change for students to observe and meet women working in technological fields.

Many of the students need to be reassured that it is possible to be a scientist and still have a family and/or a satisfying life.

Yet, some of our in our group have conflicting thoughts about these kinds of efforts to encourage women to pursue scientific or technological careers.

In spite of all the material available, it seems that very little has changed. For example, I quote from the AWIS legislative update, October 1987.

"After fifteen years of steady growth, the enrollment of women in science and engineering programs has leveled off and in some cases begun to decline both in number and proportion."

And I had that, a similar perception as I've gone to the scientific conferences in the last few years. I've sort of seen a rise and now a leveling off of the number of women attending.

Our assessment of the situation is that federal support of special programs designed to encourage and support women and girls has not been constant.

As these programs have been cut, advances have not been occurring under their own momentum. Except for small efforts like our own, the general community has not created opportunities where the public sector has left [illegible].

Presently, we are seeing some efforts on the part of the business community since they have immediate needs for people with technological expertise.

We are encouraged by this response,

however, we also aware of the cyclic nature of economics. Any programs from the private sector will vary with the employment needs --

We believe that the most effective way to increase the numbers of women in science is to educate girls and young women about the employment opportunities available and about what it is like to be a scientist.

Career conferences such as those we have organized are very important. There are many other ways to increase the numbers of women in science and technology. Among them are mentorship programs, opportunities for school children to visit academic and industrial laboratories to see what really science is actually like.

And changes in elementary and secondary science curricula to emphasize the contribution of women scientists in the past and to portray scientists as female as well as male.

We envision the federal government's role in this effort as providing coordination and information, as well as financial support for efforts at local levels.

We are aware, of course, that there are some programs in place such as the NSF Young Scholars Project, but we want to stress in this testimony that in order for programs to be effective, they must be widespread and remain in place continuously over a long period of time.

They cannot be funded periodically depending on the intensity of public opinion at the moment.

Once these programs are maintained, we expect to see significant increases in the numbers of women in science eventually reaching the point where the programs would no longer be necessary.

At this point, I want to thank you for the opportunity to share our concerns from AWIS and now Dr. Finn would like to present her recommendations as an individual and a member of AWIS.

DR. FINN: I've been a member of AWIS since 1981, when, a little bit after the founding start of AWIS because there was a group before us who founded it.

What I was interested in was in the Chicago Public School Science Fair where I organized and implemented since 1983 our awards program.

This is just part of my credentials and I see the need on the individual basis to work with students. However, what you have done in this task force is given me the opportunity to step back, look at the total picture and see what I would recommend if, but you've given me the opportunity to say, this is what should be done.

So what I'm going to present as a program for you, how I see the program should be. And certainly I see that that's your job, but I see this as a starting point for you or for input that you can use in your own planning.

Okay, I'm advocating a four-point plan and it, much of the information you have today fills in this plan.

First, an environment must be

created for the young child in our family so that she will be motivated to choose science and technology as a career in her grammar school years.

Second. The adolescent must be given appropriate counseling in high school so she takes the courses necessary to succeed in a scientific profession.

Third. And this one has not been mentioned by anybody that I've heard today for the task force. The general labor force, which is almost fifty percent female these days, must be retrained in math and science so that these individuals have the skills and knowledge to support their families since there's often single parent families and those are women.

And also, so they accept the value of science and math training for their children. This is part of the environment we have to create for children with their coming up through the world.

Four. This was mentioned a little

bit by the, first from Fermi Lab. The scientific community must be educated to accept an eventually welcome the female scientist or technologist into its midst.

Now that's what we need to address and this is how I propose to address them. First, the motivation of grammar school children will be handled within the individual school districts.

The students of this age group need constant reinforcement as I know from my niece and nephew. The individuals who reinforce their attitudes besides the parents are their teachers, however the teachers themselves must be trained to accept science and to advocate it as a profession for females.

To fill this need, what I would suggest is the National Science Foundation could sponsor training programs for teachers and can base training in these programs for some of the programs mentioned in a study "Intervention Programs and Math Science and Computer Science." That's mentioned in my references.

The National Science Foundation could also provide grants to organize these programs for the teachers.

And another thing, Internal Revenue Service could organize participation in such programs as required teacher training so that they would be finant (sic) because otherwise the teachers won't take them.

You have to address both issues.

Second. In the high schools, the counselors have the major responsibility to help young women advance on the road of science and technology. These teachers must have information on up-to-date training needs. They cannot merely -- a graduate requirement of a given state or given school district.

Many counselors do search for information. Am I done? I have one minute?

CHAIRMAN OAXACA: Sixty seconds.

DR. FINN: Two means to provide information are first the workshops that have been mentioned by various groups. And second, the actual bibliography of where you can find information on career support; again, the National Science Foundation could help organize these workshops.

Third. The business community is beginning to recognize the need to educate their workers. What I would suggest that there be a site, there be an incentive in the Internal Revenue Service, which would be equivalent to the investment incentive for the retraining of workers, particularly the lower level workers to get the math and science training that they would need.

This would be of benefit to the companies, it would be of benefit to our own country in terms of building up our labor force, the specialists and fifty percent of our people going through our baby boomers and they're not going to be caught in this early pipeline training in the next twenty years.

Four. The opportunity for women to enter and advance in the scientific community can be legislated by the Equal Opportunity, Equal Employment Opportunity Commission and an affirmative action plan.

One thing that I have as a reference is there has been a court case, even at Los Alamos National Laboratory. Women are not being advanced in the laboratories.

If you're going to have women join and have science as a career, they have to have the opportunity to advance in their career.

If that's stopped, they'll turn to other areas. That has to be opened up if you want to keep your women in science.

These are, there's more but this is the four-point program that I have suggested for you. And this program has to remain in place for an extended period for this to be effective.

It must be shielded from the cyclic patterns of politics and economics. I envision that this program will help to give each citizen in our country an equal opportunity to participate in the fields of science and technology to achieve for herself or himself the opportunity to be employed in fields which will not be eliminate ten or twenty years in the future.

Thank you.

CHAIRMAN OAXACA: Thank you. Questions from the task force?

Dr. Berman?

DR. BERMAN: I'd like to know from your personal experience I guess, did high school counseling influence your career or was it your math teachers?

DR. FINN: You really want to know?

DR. BERMAN: Was it your counselors?

DR. FINN: Yeah. I was not influenced by my counselors at all. I never had a counselor. I basically was born with an innate sense of curiosity, took things apart around the house continuously which my parents didn't appreciate.

My parents didn't appreciate that I wanted to enter science. They told me I was going to have an awful hard time. They were factory workers.

Basically, I went to the Museum of Science and Industry and had a lot of fun. It was after that when I got into science and I basically structured my own program.

But I'm unusual. That's not your typical pattern. What I do with my niece and nephew, I go over to friends kids where the mothers or grandmothers give them brooms to sweep, you know, bring other things into perspective for them, you know, it's, you can't judge by one individual.

But I've looked at students that have come through as students in programs. They haven't been given counseling, they haven't been given the fact they need business courses, they need to know how to write. Nobody's giving that to them.

DR. BERMAN: I guess I, what occurs to me is, I'm not sure the first thing I would do is tutor counselors.

DR. FINN: That's not the first thing that I said. I said you need a four-point program and all points are needed in terms of a total program.

I'm not putting priorities on any of them and I'm also saying we need, you need some incentives to have people go into these programs and there aren't any.

CHAIRMAN OAXACA: Any other questions?

Mr. Morris?

DR. FINN: I gave you a, you were asking for a lot of plans --

CHAIRMAN OAXACA:: You and I have the same concept on counselors, you know. I think Shakespeare was wrong. I think it should have been the counselors they should have killed, not the lawyers.

(LAUGHTER)

DR. FINN: Well, teachers are important though. Because I was in college, the teacher asked if I was going to graduate school and I hadn't even thought about it because there was nobody in my family had ever gone to advanced schooling.

CHAIRMAN OAXACA: If I had taken my counselor's advice today, I'd be fixing cars. Now maybe that would be bigger money --

(LAUGHTER)

CHAIRMAN OAXACA: We thank you so much Doctors Finn and Thurnauer and any information that you haven't submitted, you know, feel free to submit more, because we're going to need a lot of help in that area.

It appears that more and more it's coming out that the pipeline issue is one that you've got to go all the way to day one, so thank you so much.

DR. FINN: And you've got to get the parents.

CHAIRMAN OAXACA: Oh, absolutely. I totally agree. I totally agree. Thank you so much.

MR. MORRIS: Well, it's good to

have someone with a program.

CHAIRMAN OAXACA: Dr. Richard Neblett, the President of the National Action Council for Minorities in Engineering is the next person to testify.

And a warm welcome, Doctor. How's Bob Fennell doing?

DR. NEBLETT: Bob is doing well, you know, as far as his health is concerned. He is not yet able to come back to work.

CHAIRMAN OAXACA: Well, he and I went through the valley with MESA thing and --

DR. NEBLETT: I know and of course Bob has been in the effort for so long, made some very significant contributions, but he is just physically not able to work.

CHAIRMAN OAXACA: Oh yes, that's just too bad.

Welcome and you got ten minutes and we'll ring the bell at nine.

DR. NEBLETT: I hope I will not need ten minutes, although as I've heard some of the other testimony I've started making marginal notes and say, maybe we ought to start a debate.

Let me quickly establish some credentials. I'm President of what we will call NACME, the National Action Council for Minorities in Engineering.

My doctorate is in chemistry from the University of Cincinnati and I've spent some thirty-four years with Exxon Corporation, most of them in various technical and managerial capacities with a research company.

I ended my career as a Contributions Manager, which was quite a different activity.

Let me talk a little bit about NACME. NACME is a not-for-profit organization designed to increase the number of underrepresented minorities -- Blacks, Mexican-Americans, Puerto Ricans and American Indians who earn bachelor degrees in engineering.

And let me define. This is a narrow charter. We're not talking about all minorities. We're not talking about women, we're not talking about the handicapped and we're not talking about all science; we're talking about underrepresented.

That is those whose participation in engineering is less than their share of the population and in engineering alone.

Over the past dozen fifteen years, NACME and its predecessor organizations have provided leadership where a widening circle of institutions had -- to our goals.

School systems, universities, corporations, professional societies, minority groups and local program, collectively known as the Minority Engineering Effort.

NACME uses a variety of approaches to help achieve the goals of the national minorities effort. Our major activities are these: the incentive grants program is the nation's largest privately funded source of scholarship aid for minority engineering students.

The annual commitment totals

between two and a half to three million dollars per year and it's awarded as block grants to some one hundred and forty-five accredited engineering schools.

The money is specifically earmarked through student financial aid and ultimately assists ten to twelve percent of the country's minority engineering undergraduates.

By placing the largest grants with the colleges that successfully recruit, enroll and graduate minority students, we encourage both individual achievement and institutional change.

The Summer Engineering Employment Project puts incentive grants, recipients in touch with the real world of engineering and introduces donor corporations to promising youth.

We publish an annual directory of the NACME scholars and it helps students augment their scholarships with summer earnings. It also fosters growth of skills and relationships that can lead to permanent employment.

The Field Services Unit provides

expert consultants, vital data and statistics, sometimes necessary seed money to expand the network of programs and help minority students prepare for, stay in and graduate from engineering schools.

Our professional staff brings sufficient, effective methodology to new initiatives and going projects nationwide.

And we target the areas of the country where there are high concentrations of minority students who have been unsupported or underserved. That's we try to put new programs.

NACME has an active research and publications program to make essential materials available to students, parents, educators and corporate supporters.

Whether in the role of an information conduit, a databank or an instructional resource NACME communications form a link uniting the varied participants in the minority engineering effort.

And there are several records of

the publication that are attached to the written testimony which I have left.

We operate with an annual budget of approximately four million dollars obtained largely from contributions from private industry.

NACME is governed by a self perpetuating board of directors from industry, universities and minority organizations, one of whom was Dr. Martin who you heard early today.

I will attach our annual report to the written testimony and now let me move very briefly.

Let me summarize very briefly the progress made in the national effort. Although this effort was initiated in 1973, the school year 1974-75 is the first year for which we have recently complete data.

And comparing to 1974-75 and using the most recent data, '85-'86, minority enrollments in engineering have increased two hundred and twenty-six percent; from ninety-eight hundred to some thirty-two thousand.

The number of graduates have increased a hundred eighty-three percent; from fourteen fifty-three to forty-one zero seven. Minorities receive 5.3 percent of the engineering undergraduate degrees, as contrasted to 3.8 percent nine years earlier.

A cloud on the horizon, data not yet published but available from the Engineering Manpower Commission show that freshmen engineering enrollments among the three minority groups declined in '86-87 in total from more than 10.3 percent to 9.7 percent of the freshmen engineering enrollment.

Although freshmen enrollment overall declined, minority participation declined faster. So we're not making progress, we're going backwards.

There are many barriers and we have some suggestions about how the barriers to participation might be overcome.

Because the underrepresented minorities are disproportionately poor, college financial aid is important. Our program provides some, but only to about ten to twelve percent of minority students and that portion we provide is roughly ten percent of their average college budget.

Aid from public sources is far more important. Attrition of minority students in engineering school is unacceptably high. It's about twice that of students overall.

That is, nominal retention rates, seventy percent of graduates compared to the number of freshmen four years earlier, among minority students that figure is thirty-five percent.

We have stimulated the initiation quality minority program efforts, which include the environment with counseling, tutoring, orientation and socialization efforts.

But all of these need to be institutionalized. We observe that the colleges that seem to do the best jobs are those with both adequate and stable financing for the minority support programs.

And something I think Dr. Martin did not mention out of maybe a false sense of modesty, the programs that work best are those that have the institutional commitment from the president on down and Tom is certainly one of the paragons where other presidents -- to emulate.

We also need to arose more interest in math and science based careers among junior and senior high school students. We're quite supportive of the many pre-college programs that have started in the past ten to fifteen years.

Among the states, California is the one that has made the largest commitment to public support of these efforts, it's known as the MESA Program, the Mathematics, Engineering, Science Achievement.

But it is our conclusion, derived from and shared by some of the most expert and thoughtful investigators in this area, specifically Professor Edmund Gordon of Yale and City College and his colleagues that the pool of adequately prepared minority youngsters is now too small to achieve dramatic increases in participation in engineering.

Let me repeat that. The pool of adequately prepared minority youngsters is now too small to achieve dramatic increases in participation in engineering.

This conclusion could also be extended to other quantitative disciplines as well. There is considerable evidence that engineerging already attracts fifty percent or more of the minority students identified as academically able.

Further increases in successful engineering education of minorities must come from expansion of the pool.

For engineering to have fifty percent is laudable, but that's bad social policy. We need talented minorities in all fields of human endeavor, not solely in engineering.

Expanding the pool of academically able minority students must, of necessity, begin in the early education.

Recent data show that minority youngsters are identified as behind in mathematics achievement as early as age nine and the gap gets wider with time.

Early education is not the province of any national voluntary organization. It's the responsibility of the states and local boards of education.

National leadership is imperative. This nation cannot stake its technical competence upon the least capable, least well financed local board of education, it's a national problem.

For this reason, we urge this task force to consider very carefully what you've heard from the other people who have testified here today.

Engineering education is a career trajectory that begins at a very early age. To improve participation, especially minority participation in the -- intervention is required at all stages; at elementary education, on competence in math and interest in science.

At the secondary level, more rigorous math-based curricula and teachers who are both more competent in the subject matter and sensitive to the needs and aspirations of minorities.

At the college level, financial aid, better articulation between community colleges and four-year institutions, more minority faculty, more minority teaching assessments.

And certainly at the graduate school, minority, more minority graduate students as a source of those teaching assistants and the faculty that will be needed in the educational system.

Thank you.

CHAIRMAN OAXACA: Thank you. Ms. Winkler.

MS. WINKLER: Dr. Neblett, I -- hear any comment you have on, I think it was Dr. Martin's statements on, I think it was taking the best and kind of pulling them out --

DR. NEBLETT: Oh yeah.

MS. WINKLER: I'd be interested in what you have to --

DR. NEBLETT: Tom and I, you know, here is a board member. I still disagree with him on that. I agree that the best practice of science and engineering require the very best minds that we have.

I would disagree that it is possible always to identify those who could be successful so early.

Ninth grade algebra is the key, but there are other intelligent, able students who don't get tracked into the right math courses. Where can we find them? Some of them are still in the community college.

I think that there is talent that we have have not yet tapped, not yet identified. I'm not disagreeing with the necessity for competence in the practice of these very difficult fields, but I think we can find them earlier than, an then we can even find them later.

MS. WINKLER: What about the idea of given limited resources, should the policy direction be to define these few wherever you can find them and select them out and treat them differently?

Or would you -- toward more general, perhaps slower improvement of the --

DR. NEBLETT: I would, I would opt for the improvement of the public education system. If you wanted to make a long term and I think we have to look at a long term solution.

What we're doing is a small part of a general national deficiency. Minorities aren't education well for any field for the most part and we've got to improve that system.

CHAIRMAN OAXACA: Any more, Mr. Fernandez?

MR. FERNANDEZ: I totally agree with you on the emphasis of the elementary -- school levels -- the thing that I keep hearing is that's a prime target and that we should focus on it.

What I don't hear though is, what can the universities do to train teachers without having to wait until they have salaries that we pay engineers to motivate them.

DR. NEBLETT: Why should we not pay math and science teachers the salaries that we are willing to pay engineers?

I'll give you a good example. I live right down the hill from Bell Labs in New Jersey. We start out our beginning teachers at -- sixteen or seventeen thousand bucks, competitive with other school districts in the area.

But that same teacher, if he's a math teacher can go right up the hill to Bell Labs and make six to ten thousand bucks more a year.

What are you going to do? We have got to reward --

MR. FERNANDEZ: I agree with you and I'm in full support of that.

But the universities have to start to taking some initiatives, some place to train the teachers.

DR. NEBLETT: I think that what they need do, should do is to increase the subject content of a teacher's training.

There's enough petagocic (sic) talk, but we ought to, a math teacher ought to be competent in math and many are not. Science teachers ought to know science and many are not.

We've got, you know, high school athletic instructors teaching science.

CHAIRMAN OAXACA: In California, the issue came up that it made more sense to pay a higher salary to a math and science teacher than a teacher that was teaching geography and world went unstable when that idea --

DR. NEBLETT: I'm sure it did--

CHAIRMAN OAXACA: Because --

DR. NEBLETT: (continuing) -- I'm been on a board of education, I know --

CHAIRMAN OAXACA: (continuing) -- because the Teacher's Union said, you know, all things are created equal and it would be a dark day if we ever allow there to be an imbalance in the value of a discipline. Forget the law of supply and demand, which I personally don't agree with --

DR. NEBLETT: Universities pay engineering faculty more, they pay business faculty more, they pay law faculty, medical faculty more. The law of supply and demand seems to work everywhere except in the public school teaching system.

CHAIRMAN OAXACA: It doesn't seem to work in California, I don't know how it is in Chicago.

Any other questions?

(NO RESPONSE)

CHAIRMAN OAXACA: Thank you very much, Doctor.

DR. NEBLETT: Thank you.

CHAIRMAN OAXACA: I'd like to welcome Dr. Donald Langenberg, who is the Ex-Deputy Director of NSF and now the Chancellor of the University of Illinois at Chicago.

Thank you for hanging on this late

in the afternoon and the very fact that it's this late in the afternoon, we'll still be mean when the bell rings.

DR. LANGENBERG: I'll try to be very brief.

Thank you very much for having me. A few words about my institution, UIC, if I may, because it'll give you some sense of the background from which I currently speak.

It is one of two campuses of the University of Illinois. It is located in Chicago, within walking distance of this point. It wouldn't take you more than fifteen minutes to walk to my office.

It is one of the seventy institutions across the country classified by the Carneige Foundation as a Research I university. It is an institution which draws most of its students from the Chicago metropolitan area and indeed from the County of Cook and within that, the City of Chicago.

Most of you know that the City of

Chicago has one of the most stunningly ethnically and culturally diverse populations to be found anywhere in the world and that's true of our student body.

Of those elements of our population, conventionally classified as minorities, the Black enrollment at UIC stands third in the country of those seventy Research I institutions behind only Howard and Cincinnati.

The Hispanic enrollment stands seventh in the country and we are the only institution in the top fourteen, outside the southern tier of states from California to Florida and somewhat surprisingly, the Asian Pacific Islander population enrollment in our student body is eleventh in the country.

And again, we are the only institution not within a couple of dozen miles of the Pacific Ocean in that group.

I would like to suggest that this means that we know how to educate for the sciences and for engineering minority students and I wish I could tell you about all of the neat things that we do that makes us such a success.

I say I'd like to do that, but I can't because I don't think we are a success. I don't think any of our peer institutions are a success and in fact I find myself spending a lot of time being disappointed, unhappy and frankly, frightened half to death.

Frightened for my own institution because I can see a decade coming, a couple of decades coming in which we are going to have to replace a large faction of our faculty.

We are a relatively young institution, we hired a lot of faculty in the sixties and early seventies and a lot of us are going to be retiring around the turn of the century and we are going to need to replace those faculty.

And we're going to need to replace them from a pool which overall is a lot smaller than I would like to see it. It is not as good as I would like to see it. We have suffered from a decade or two of common knowledge that the world is full of cab drivers who have PhDs.

Whether it was true or not doesn't matter. That was the knowledge and there are people who might have Ph.Ds today that don't, but rather have JDs or MDs or DDSs.

And it is abysmal -- in the minority PhDs that we need for our faculties to provide the role models; to provide the skills and provide the expertise we need to keep going and try to do something about a generally abysmal performance in educating minority students at both undergraduate and graduate professional levels.

I attended a conference organized by Betty Vetter a couple of weeks ago. I think it was at that conference that I heard yet another one of these dismal statistics.

Thirty-five hundred PhDs in a recent year in the physical sciences in engineering, fourteen hundred and fifty to foreign nationals, seventeen to American Blacks, thirty-eight to American Hispanics and as I recall four to Native Americans.

That's ridiculous. I don't know how many success stories you have heard today. I'm sure there are some, but something is badly wrong and I don't think any of us really know how to fix it or what to do about it.

I'm also frightened because I worry about the economic vitality of my country and I worry about its national security, as I suspect we all do.

Preserving either or both those two things is going to require talent. And talent seems to be in very short supply.

We have habitually drawn on about a third of the possible pool for our talent; that part of the pool that is both male and White and as that pool decreases in number, so does the talent available in it for science and for engineering.

And we simply can't abide that. We've got to have the talent from the entire pool.

It's short enough in the -- but we've got to find a way, I think it's a matter of survival.

One can argue access, one can argue equity, one can argue adequate representation. What it comes down to in my mind in the end is just plain old national survival.

There are a couple of, I could give you a list of things that we are doing, some of which I think are worth continuing doing.

Some of them do go to the question of how one begins to influence the public school and heaven only knows here in Chicago in public schools we have all the problems that appear anywhere else in the country in the public schools.

We need to pursue those. I could tell you about some programs we have to retain students, minority students and other students that we do manage to enroll.

I could tell you about some programs to encourage minorities to pursue graduate education, leading perhaps to academic careers and I will list some of those in my written testimony.

I would like to suggest, however, together with a prior speaker that despite the fact that in this nation we have habitually seen education largely as a matter for state and local governments and for the private sector; that we have before us a national problem and a truly serious national problem. I frankly think it's a lot worse than various fluctuations in the stock market in the long run.

And it seems to me that it needs to be addressed, at least in part, on the national level.

I'd like to suggest two very general areas in which I think we ought to concentrate. Without being very specific, I won't be specific because I'm not sure I can give you super-duper ideas specifically.

It's one of the perils of being a university chancellor or president because you know very little about an awful lot.

One is that I think we must do something to, I will say, rehabilitate, reform our federal and dependent state financial aid for students. We can attract them and persuade them that it's okay to be a scientist or an engineer, but if they can't stay in school, it won't do a bit of good.

Our students are undergraduates here are typically first generation Americans to go to college. Almost all of them work, at least part-time, a lot of them work full time.

We estimate that the average work week, paid work week for our students is about twenty-six hours a week.

And it generally takes them five, six, sometimes even seven years to get a Bachelor's degree because the cannot go full time. They drop in, they drop out. They go top off the bank account by working full time, they come back to us.

And that situation would be much improved if there were a stable, reliable source of student financial aid with a large federal component that was not primarily loans. If it was grants and I think this is particularly important for those of our students who are economically disadvantaged and a lot of them are minorities.

It can be argued on a rational basis that a loan burden of ten, twenty, fifty, a hundred thousand dollars at graduation is nothing compared with the lifetime increase in salary that will accrue to a person possessing that degree.

That's all very well, but to a young man or woman from the south side of Chicago whose family income is ten thousand dollars, that looks like an absolutely insuperable barrier and they simply can't get over it, however rational the argument about increased life income is going to be.

We need, I think in short, to redress the balance between loans and various sorts of grants in the federal financial program.

Finally, I think we need to know a lot more, which means research and we need to be able to apply a lot better what we do know and that means development in the area of education and in particular, education in mathematics and science and engineering and technology at all levels.

Frankly, beginning with nursery school. I think we've got to start early and I think part of that is reliance on investment, continuing investment in some known programs that work.

One of the things that has become clear in recent years is that Head Start does work and it seems to me there's the place where investment would be worthwhile.

I think I'll stop there Mr. Chairman and I would be happy to respond to any questions.

CHAIRMAN OAXACA: Questions from the task force.

MR. LAUGHTER: One quick one, because I know we're timed.

You're talking about a pool

shrinking. Now is that just the minority, women, handicapped pools or is that an overall pool of people, because we've got so many students today -- in college --

DR. LANGENBERG: In this part of the country, the overall pool is shrinking. The distribution within that shrinking pool is changing.

Here in Chicago, for example, the Hispanic portion of the pool is increasing relative to both Black and the other portion of the pool. But the overall pool is shrinking and been shrinking fairly rapidly.

It's true what the demographers say and although it seems very hard for some people to grasp even in my own institution, next year's freshmen has truly already been born.

CHAIRMAN OAXACA: Any other questions?

(NO RESPONSE)

CHAIRMAN OAXACA: Well, I surely agree with what you're saying and more and more we're noticing that you've got to right down to the, on day one, you've got to grab them, because otherwise there's going to be a problem.

And I don't, I don't know, that's one of the reasons that we're pushing so hard to have a media blitz and to get to the presidential candidates and the congressional candidates to make this a national agenda.

I don't believe you can band-aid it, you know, the band-aiding has really not worked. It's going to have to be a national agenda and we thank you for your time.

DR. LANGENBERG: You're very welcome.

I would ask Mr. Cecil Curtwright, the Chair-Elect and Derrick Scott, Chairperson and Deborah Minor, I guess you're representing all three?

MR. CURTWRIGHT: All three.

CHAIRMAN OAXACA: Mr. Curtwright is Region C, National Association of Minority Engineering Program Administrators and we thank you for hanging in here this late and for taking the time to address what we've all known and are even further being strenghtened that it is a major issue in our country.

MR. CURTWRIGHT: Thank you for having me.

First, my name is Cecil Curtwright. I'm the Director of the Minority Engineering Recruitment and Retention Program at the University of Illinois at Chicago, from the institution that Dr. Langenberg just spoke about.

And I'm also the Chair-Elect of Region C of the National Association of Minority Engineering Program Administrators.

Region C primarily is made up of the states of Illinois, Indiana, Ohio, Wisconsin, Michigan, the traditional midwestern states.

In consideration of the time, I'm not going to go through the entire statement because I think it will run over ten minutes and we have submitted it into the record.

To give you a brief synopsis of

what the National Association of Minority Engineering Program Administrators is all about. We're a broadly based organization at the university, industrial and other educational professionals, working co-operatively to increase the recruitment, admission, retention and graduation of traditionally underrepresented minority students, Blacks, Hispanics and Native Americans in the engineering profession.

Earlier there was some mention of those individuals at the university who serve as the parents. Well, this is the PTA when it come to minority engineering.

The association integrates three distinct, but interrelated programmatic areas. They are pre-college, college and graduate.

The MEPA was established to provide a unified perspective on the concerns and issues that are vital to the success of the minority engineering effort.

It serves as an advocate for the academic, vocational, emotional and social needs of minority engineering students.

It also provides a forum for discussion of issues vital to the success of the effort.

Now I'm going to skip a lot of this preamble that we prepared and get right to the point in terms of what we consider to be vital issues. And the paper that I am reading from is called "Vital Issues: Looking At The Minority Effort Into the Year 2000."

Well, before I can say that, I guess I should say -- as Dick Neblett mentioned, the minority engineering effort started in 1973, and it started with a lot of high hopes and expectations that within ten years we would reach parity in terms of the number of minority engineering students who had graduated; parity in terms of our representation in the population, in the United States population.

And what we've learned from that time is that first of all, some of the problems and some of the barriers continue to persist.

And among them are the oversimplification of goals and the overstatement of outcomes regarding the effort.

Number two, the lack of an unyielding commitment of the nation and its institutions to complete a successful implementation of the minority engineering effort.

Number three, the need for more effective networking and cooperation among pre-college college and graduate level programs.

Four, and this is extremely important, the lack of accurate documentation of results.

Five, the need to address the varying ethnic and regional needs of programs and students.

Six, the persistence of ineffective and desperate K through 12 math and science instructions accessible to most minority students.

And I believe number seven now, the limited achievement of goals established for the effort in 1972 and 1982 we came up with some new figures in 1982 and the need to continue to address this overwhelming and complex social, educational and economic task.

These reoccurring things point out that while results have been achieved, the end of this effort is not in sight. It's really just beginning.

What we have learned in preparation for the task which lie ahead is that there are many vital issues that the MEPA must and will address.

Those issues are, and I'm not going to read all of them. At the pre-college level, issue number one, the decline in the number of minority students prepared for and participating in full secondary education.

In spite of an increase in the number of minority and high school graduates, without determining and ameliorating the cause for this decline, a generation of minority students will be unable to make productive contributions to themselves and to the nation.

Issue two, the deficiency in partnerships between community colleges, high school and college programs. The lack of networking in cooperation between these educational components constrain efforts to identify and eliminate leaks in the pipeline.

It also minimizes efforts to formalize linkage with an educational option, community colleges that minority students are already taking advantage of in large numbers.

Issue three, the shortage of effective and well-funded pre-college engineering preparation programs that focus on grades K through 8.

Issue number four, the limited availability of certified and certifiable subject matter teachers in math and science and schools serving predominantly minority populations.

Issue number five, the continuing inappropriate matching of minority high school graduates to engineering programs and institutions of higher education.

Issue number six, the need to develop effective databases pertaining to minority students who graduate from pre-college programs and enroll in college level engineering programs.

Issue number seven, the need to identify and publish the results of pre-college programs that have consistently and successfully graduated students for -- enrolled in engineering programs.

I might also add that as I read these issues, we actually have rationale for each one of them and I'm skipping all of that because it is in the record.

At the college level, issue number one, limited understanding or appreciation by universities and engineering programs of their ethical responsibility to recruit students who have demonstrated the potential to be academically successful in those particular institutional environments and I will give you the rationale for that.

The current selection processes have the tendency to accept students simply in order to meet enrollment or student affirmative action needs.

Institutions are therefore in too many instances accepting students that cannot, they cannot educate and graduate rather than the first.

Issue number two, the persistent decline and the retention rates of minority freshmen students in engineering, this negatively impacts graduation rates and stifles progress toward achievements of the benchmark goals established for the effort.

Issue number three, this, I think is very important. It is something that our organization is getting ready to address and we would like to get the National Science Foundation's help in this effort.

The exclusive focus on freshman recruitment as an enrollment source. This approach limits access of, limits access and provision of services to transfer and other upper division students.

As a result, many students with appropriate backgrounds may not have the opportunity to pursue engineering. And I guess in a sense that may be my response to Dr. Martin's comment about getting students, the top five percent and identifying them very early.

The fact of the matter is that there is an extremely large pool of minority students who are in the community college system and I've recently looked at some data that suggested that fully twenty percent of the Black males who are eligible to go to college enter the military, when they need the military.

Oftentimes, they want to continue their education. We just focus everything on high school students and what have you. We've got a sizable proportion of young men out there, oftentimes who've gone into the military to be all they can be, thinking that they will get some type of technical training, what have you.

If we limit all of our efforts at the freshmen level, elementary school level and what have you, we will leave out that substantial group.

Issue number four, again at the college level. The unchallenged escalation of engineering school entrance requirements, particularly in the area of ACT and SAT scores. This is true at some institutions and not true at others.

This strategy obviously limits access to engineering programs and institutions and could consequently result in fewer minority engineering students and graduates.

Issue number five, and again this is an issue that only impacts some of the colleges of engineering across the country.

The continuing escalation of entrance requirements for popular engineering majors. There are some institutions in the midwest, some of the Big Ten institutions that will admit you as a freshman, but you are not able to declare a major until you have a particular grade point average.

At one institution, in particular which will go unmentioned, to major in chemical engineering a couple of years ago, you had to have a 3.75 GPA on a four-point scale to enter the chemical engineering department.

MS. WINKLER: -- for freshman year alone.

MR. CURTWRIGHT: Right. Issue number six. The failure to involve all engineering school academic personnel, staff and alumni in improving a personalization and implementation of academic support services to students.

Issue number seven. The need to cultivate the current student attitudes regarding the importance of academic excellence and the need for rigorous efforts and discipline. And I will give the rational for that without making academic excellence a priority.

Students are less likely to

optimize their opportunities to obtain the most competitive academic results.

Issue number nine. The need to identify and support undergraduate retention programs that have consistently and successfully graduated -- numbers of minority students.

Implementation of the strategy to identify the more successful programs is essential if we're to be in a position to repeat on a larger scale those intervention strategies that are effective. It could help in identifying the characteristics of such students.

CHAIRMAN OAXACA: Ms. Winkler.

MS. WINKLER: I'd like to say, you have the most well thought-out, concrete presentation we've heard and we congratulate you on that.

One question I have, I don't know if you have any data, but -- a sense of reality, what kinds of schools, I'm speaking of high schools, are young Black engineers, young Hispanic engineers coming from?

Are they coming from inner city schools? Are they coming from suburban schools? Are they coming from public or private or where's the main source? Where are the main sources?

MR. CURTWRIGHT: Unfortunately, when you talk about expanding the pool for minority students, engineering schools, because of their reliance on ACT scores, course pattern requirements, the fact that there is a little of a -- all engineering schools, have a tendency to try to go for the best, to try to go for the cream of the crop.

Dr. Neblett mentioned earlier in his presentation that clearly fifty percent of the top minority students are being careened into engineering and it makes me wonder that if businessmen had got out there earlier than we had, would we have a whole bunch of Black and Hispanic business people or attorneys or people going into the health professions.

The fact of the matter is, from my vantage point, the majority of the Black and

Hispanic students who are matriculating through colleges of engineering across the country are coming from suburban high schools, magnet schools, for instance in this city, private schools, parochial schools.

And we are really not touching the inner-city high schools period. It's not happening.

CHAIRMAN OAXACA: Yes, Ms. Guerra.

MS. GUERRA: What percentage would you say are on scholarship programs, as opposed to working their way through?

MR. CURTWRIGHT: Well, Dr. Neblett mentioned that his program alone supports twelve percent of the minority engineering students across the country.

When you add industrial scholarships and some university scholarships, as well, in my particular program, last year our enrollment was two hundred fifty-one minority students and well over seventy of those students won some kind of scholarship, either from NACME or from the institution or from industry.

And I think that would be representative of most minority engineering programs. So we're talking about perhaps twenty to twenty-five percent on straight academic scholarships, separate from federal or state financial aid.

MS. GUERRA: Does your association also offer some type of counseling as they're going through the program for those that find it difficult or get discouraged or --

MR. CURTWRIGHT: Actually, we put this organization together to counsel one another.

(LAUGHTER)

MR. CURTWRIGHT: They had first started in 1972 and this organization was formed in 1982 because quite frankly a number of us were going through burnout, there was no national direction, we were calling one another up on the phone, etcetera, etcetera.

Now if your question is, do we do counseling in our individual programs, yes. We also exchange students among one another.

One of the things that's very important is institutional fit. And if we find that a student cannot make it at the University of Illinois because of class size or a smaller environment, they may work out better at Wilberforce, let's say or to Illinois Institute of Technology, we will do that.

CHAIRMAN OAXACA: Mr. Scurry?

MR. SCURRY: Let me join my colleague from the Department of Education on complimenting you on the quality and -- of your testimony. At this late date, I think you -- quite well to be alert.

One of the goals that we have to concern ourselves with in this task force is employment.

Do you believe that the graduating minority engineer and I think, I want to just stick within minority if you will, will be given a fair and equal chance to seek and gain employment in the federal sector and be allowed to achieve to his or her highest potential?

MR. CURTWRIGHT: I have no reason not to believe that. However, the situation that I'm confronted with in my program is that most of my students do not want to work for the federal government because your salaries are not competitive.

Most of my students start at thirty-one thousand dollars.

MR. SCURRY: I hear you.

(LAUGHTER)

MR. CURTWRIGHT: That's the bottom line there. And unless they want to work for the federal government, I've had a few of my students obviously who would like to work at an Argonne National Lab or work in summer, there's a facility in Indiana that works, the naval something, okay?

A lot of them will want to go there and work with radar and that sort of thing. But for the most part, no way. The salaries simply are not competitive and these students, once they graduate, they are really picked over.

And if the student has a "B" average or above, not only are they getting these very high salary offers, but then I'm trying to push them to go to graduate school.

So they're getting it from everywhere. I have to be honest, the federal government just isn't in the ball game in terms of competiveness.

CHAIRMAN OAXACA: Ms. Freeman?

MS. FREEMAN: Do you have any contact with the ROTC programs that various colleges and you mentioned that a lot of junior college students are previous service members and you're going through the junior college, well, do you find that the ROTC Program is a useful discipline based, a training program and do students feel that they're getting something out of it if they do participate in it?

MR. CURTWRIGHT: From my experience at my campus, again, out of the two hundred and fifty some odd minority students we have in our program, I doubt if we have five students that are going through the ROTC Program.

MS. FREEMAN: Do you have any feel for why that, is that --

MR. CURTWRIGHT: They are not interested.

DR. BERMAN: Do you have an ROTC--

MR. CURTWRIGHT: Yes. Oh yes, absolutely. They are, I've got some students who are interested in being naval aviators after a couple of top gun movies and what have you --

(LAUGHTER)

MR. CURTWRIGHT: (continuing) -- go the route of ROTC, but for the most part, the students are not interested.

MS. FREEMAN: As a way of --

MR. CURTWRIGHT: At least that's my experience at my campus. I can't speak for the rest--

MS. FREEMAN: So it's not known as a viable method of getting financial aid?

MR. CURTWRIGHT: It's known, but it's not utilized because a lot of the students feel that the payoff in the end is, "I have got to go into the military for whatever length of time that is and I know it's not very long" and they're looking at that thirty-one thousand dollars coming from Amoco and IBM and what have you.

CHAIRMAN OAXACA: Thank you very much. Oh, one more.

MR. FERNANDEZ: The dunk (sic) has already started on two-year institutions. You mentioned the ACT, SAT admission standard for financial, the tuitions going up, the minorities are already being dunked on two years --

MR. CURTWRIGHT: Right.

MR. FERNANDEZ: Do you have any bright ideas of how we can force the action to want to improve the quality of college prep -- two years. Secondly, once that's done, the four-year institutions to directly get involved and accept the transfer.

MR. CURTWRIGHT: Oh, I've got a lot on that and it would take more than the time than

I have here.

But just as a suggestion, you heard the presentation from the President of Wilberforce and they have a three-two program with the University of Dayton.

Georgia Tech has a three-two program with the historically Black colleges in Atlanta. I think that what senior institutions would have to do would be to set up similar programs with the community colleges, but specifically for engineering and math-related academic careers.

Essentially, what I'm saying is that, at our institution, the minority engineering students are treated special. They are special people.

At the community college, students who have identified themselves as individuals who want to matriculate through the community college, go to a senior college and get a degree in engineering, they have to be treated specially and there has to be pre-engineering programs in the community colleges.

And there has to be a very strong linkage with the senior colleges, perhaps going as far as guaranteed admission, perhaps students taking some courses at the senior college, some at the community college or what have you and just forming a very, very tight bond.

As it is right now, the students the community colleges, in my opinion, is simply floundering.

DR. HAINES: Can you expand your testimony to give your thoughts on that?

CHAIRMAN OAXACA: You mean the written?

DR. HAINES: Yes.

CHAIRMAN OAXACA: Could you do that?

DR. HAINES: Please?

MR. CURTWRIGHT: Oh, sure.

CHAIRMAN OAXACA: We would really appreciate that.

MR. CURTWRIGHT: Certainly.

CHAIRMAN OAXACA: We thank you. And now --

MR. CURTWRIGHT: Thank you.

CHAIRMAN OAXACA: We will have the final testifier and we want to thank you so much for hanging in here until the last.

You're to be commended and we got fifteen minutes all total so we can all go to catch our airplanes at 5:00 o'clock.

So we welcome Ms. Carolyn Stern, a second year medical student from Northwestern University. Welcome to the task force.

MS. STERN: Thank you. As you said, I'm Carolyn Stern. I'm from Northwestern University and basically what I'm here to do is I'm here to tell you my personal story, okay?

I believe I was very fortunate as a child because I was never taught the meaning of the word "can't." I was always encouraged by my parents to try new experiences and participate in activities not normally thought that a hearing-impaired individual can do -- ballet, piano, violin, which I gave up after about two years because they, I had to put string on the neck of my violin and by that time I had so many pieces of tape on there, I didn't know what note to play.

But indeed I'm sure I ran my parents ragged and everyone else involved running me around to all my activities. I was always treated as a normal child who just could not hear sometimes.

I was born with cebutibal bound bilateral sensory neuro hearing loss due to maternal rubella and I was fitted with aids at about sixteen months.

Some of you may not quite understand, just to give you a typical day, most of you get up in the morning, the phone rings you can hear it, you wake up to a little beep, beep, beep alarm clock and you run off to work and you make all your phone calls and stuff.

Well, for me I require for example a flashing light alarm or a pillow thing that vibrates. If I need a phone, I need to use a volume switch. Sometimes I use a teletypewriter which communicates back and forth with other deaf friends of mine.

In a typical day, I use a FM system which is like a wireless system where the professor wears a transmitter and I wear a receiver.

And occasionally for discussion groups, I require an interpreter, okay?

From the time I was sixteen months to about ten years of age, I lived in New York where I receive private therapy outside the public school system in language development and auditory training.

Upon moving to Maryland and to Montgomery County, which has an excellent support services system for the deaf, I received special services through the public school, auditory teachers and years of speech therapy.

Allow me to mention that I've always been mainstreamed in a public school system and have taken intensive and advanced placement courses offered which challenge and intrigues me.

I've never attended a school for the deaf and as I will demonstrate, I believe I've succeeded.

My many and varied experiences throughout my high school and college years have contributed, I believe, to a large part to my success today.

Participation, involvement and learning were and still are the driving forces in my life today. To this effect, I participate in many activities both within and without the school system.

Most importantly, I did not feel very restricted at all in any way to participate. To cite a few examples from the many, Secretary-Treasurer of the Science Club; participated on -- math teams junior and senior years of high school. I performed -- Montgomery County with Deaf Dimensions, a song and dance company.

During my summers, I participated in a variety of activities as well. I include sleep-away camps; gifted and talented programs; behavioral sciences for two weeks; National Science Foundation, six week -- science program at Penn State University; traveled behind the Iron Curtain; worked in research laboratories with David Taylor, Naval -- Development Center as an engineering aide; Vincent T. Lombardi Cancer Research Center, Georgetown and Bethesda Naval Medical Center in hematology, oncology and infectious diseases.

Including this past summer where I was a counselor for a group of learning disabled, mildly retarded, emotionally disturbed adolescents.

I've always wanted to be a doctor, but perhaps what really influenced my decision was when I was a senior in high school.

While there, I enrolled in an anatomy and physiology course and I loved it. My teacher for that course was my mentor in a way.

The first day of class she explained that she was an epileptic and would anyone volunteer to get a substitute should he have a seizure.

I sure raised my hand high. I had great respect for him, yet it was not until my senior year at Case Western Reserve University that I realized how much strength and courage it took for him to mention is impairment.

Although throughout college I had access to a xerox machine, I really needed note takers for my level of study, which was in biochemistry.

I thought about my anatomy teacher and said to myself, "I'll do it. I'll stand up in front of the class and tell them that I need help."

The first time I did it nobody came and I felt really hurt, but the second time I went up there again and two people came up and volunteered.

To mention a funny incident, one day for an abnormal psychology class I was asked to talk about my hearing impairment to the class and what my needs were.

I'm not sure that people fully comprehended, but after class two people that had missed class the day before came up to me and asked me if they could borrow my notes.

I guess I stood up there in front and looked studious, but the point is clear. Many do not really understand the needs of a handicapped individual and this might be emphasized.

My junior year, I wanted to go overseas to England. To go through with the plans, I needed to talk with my pre-medical advisor, Dean Davis.

In the course of our conversation, he asked me, "Carolyn, tell me something. I know you haven't had any major problems here at Case Western, but what about the fine accents in England?"

To this I replied, Dean Davis, I've had a professor who stutters, two professors from Australia and India with terrible accents and I've had professors who can't teach at all --

(LAUGHTER)

MS. STERN: (continuing)-- why shouldn't I be able to do this?

Needless to say, I went and I had a wonderful time. I was on my own and it was time to learn what my abilities and limits were and how to adjust and cope with them.

My senior year, after having taken the -- class and having applied to the various medical schools, I had five interviews: Northwestern, Case Western Reserve University, University of the Health Sciences, Chicago Medical School, the University of Maryland and Penn State.

Practically no one asked me about my hearing impairment at all. With my curiosity fully in tact, I asked one of the interviewers why he wasn't even curious about my hearing impairment.

He replied to the effect that apparently they do not discriminate on the basis of handicap or illness, unless they felt very strongly about it. They leave that decision up to the person involved.

When I got accepted at Northwestern, I was thrilled. Needless to say, I was still apprehensive about asking for any special services for fear that they would reject me. How wrong I was.

But I now use an FM system as I mentioned before and I wonder how I got by without it. It is great.

Occasionally when there is to be discussion in a class or more than one speaker talking, I tell the school that I need an interpreter and they provide me with one.

At present, I'm a sophomore medical student, equipped with my weighted-down coat full of medical equipment, including my amplified stethoscope with a little more knowledge than my first year cohorts, learning rapidly about myself and ways to break down communication barriers between myself and others, including my patients.

But I hope to be a role model for

others and to encourage them to try to be what they want to be. As for what kind of a doctor I want to be, let's just say a good one.

I wholeheartedly encourage becoming involved in support groups. Not only for social reasons, but for educational reasons.

I myself belong to Alexander Graham Bell Association for the Deaf, National Association for the Deaf, Self-Help for Hard of Hearing.

Society must continue to make opportunities available for all kinds of people. People are society's biggest investment.

One cannot foresee when one educates the person what they will contribute to society. And we, as a whole, deserve that investment, just like anybody else.

With little help and planning on the part of society, all people can function, learn and contribute, because they had the opportunities to learn.

There are ways of dealing with the

problem. Once they are dealt with, all can participate. A mind is indeed a terrible thing to waste.

Thank you.

CHAIRMAN OAXACA: Thank you. Ms. Winkler?

MS. WINKLER: That's really a very interesting presentation. It's nice to get a sense of reality.

I wonder if you have any advice for us on programs or activities, areas that we should concentrate on as far as helping the handicapped prepare for careers in math and science.

We have asked that question of most of the people here and I think your experience would be very well --

MS. STERN: The thing is that there is a lot of stereotypes, starting from when kids are very young and those stereotypes must give a, for an example, you see on TV boys playing with macho man and you know space ships and girls playing with dolls. I mean, it starts right there too.

The student must be, I feel, mainstreamed within the school system. You can't separate these individuals out.

Okay, separation to some extent is good, but I think these people must be exposed to the mainstream environment.

When I was at camp this summer, working with the children was in the main frame of the whole camp and children got to see that, you know, they could talk with them, they could have a good time and you know for the most part it was hard for these kids to develop friends.

But at least other people were made aware of the student. Also I found a tremendous lack of information, okay?

In Maryland, my parents basically had to figure, you know, what's going on here and find people to you know talk to and they got referred to eight zillion different people who knew nothing at all, okay?

There must be an information base

from which people can work on.

CHAIRMAN OAXACA: Ms. Freeman?

MS. FREEMAN: You have obviously extraordinary parents and you are an extraordinary person.

Your parents had the wherewithall to seek out the kind of assistance that you needed and the stick-to-it-tiveness to make sure you got the very best education and etcetera.

How would you suggest we develop a policy that would reach those children who are handicapped such as you are that don't have parents who are as insistent in terms of getting the kind of help and encouragement that is needed?

MS. STERN: Once again, I encourage support groups to go out and there and things and also it starts very young with the primary care physician that you get who says, "Your child has a problem" and he can probably give you some sources of information with regard to that.

To those people who are in foster homes and who have people that, divorced parents or problem families, once again support groups should indeed help that.

The finances, unfortunately, are not made available and I really regret that, because not enough people know about a lot of the things. I find mostly a lack of information to be a primary problem, as well as finances.

Everybody deserves the best type of education that they can get.

MR. LAUGHTER: May I just one --

CHAIRMAN OAXACA: Mr. Laughter?

MR. LAUGHTER: It's refreshing to have you here. I think though I can speak for all of us, because it goes back to the old saying, "If there's a will, there's a way."

And we're here to try to help the handicapped or the minorities and the women. And to have you here and show us what can be done, I think it all gives us an inspiration to where we work a little harder in the future for this area.

MS. STERN: Thank you.

CHAIRMAN OAXACA: Dr. Scadden?

DR. SCADDEN: I think it would be instructive to the task force if you could tell us how you obtained the special devices, such as the amplified stethoscope and any other type of devices that you need the assisted listening devices that you need in your student work and future career.

How are they paid for?

MS. STERN: Okay, it depends on the system, okay? For the most part, I did not even find out just -- lack of information. I did not really find out about listening with assisted devices until I was a senior in high school.

So all the while, basically all I had were note takers or I'd have to struggle through the classes.

Senior year in high school, I found out about Alexander Graham Bell Association for the Deaf and I've gone to three conventions so far, where they provide with a tremendous number of listening devices.

That's why I'm talking about these support groups. They're also educational as well.

I go to these conventions and I see what people are like, there's people that are very much like you and they show you what they use for assistance and support.

Lots of companies manufacture Dartee (ph) made the stethoscope, okay, Telecom for TTYs, Phonic Ear, Telex for the FM systems and stuff like that.

Companies from all over come over to these things and publicize their products, okay.

As far as payment, payment for interpreter services and some of the Telex system is paid by the school. I bought my own Phonic Ear system since I did not know what the school would provide.

TTY, I bought myself. There are some discounts for the deaf, but magazines that are published by these organizations as well.

CHAIRMAN OAXACA: Any other questions?

(NO RESPONSE)

CHAIRMAN OAXACA: Well, we thank you so much and the best was for the last.

(APPLAUSE)

CHAIRMAN OAXACA: The meeting is adjourned. Thank you so much for coming.

I guess the next one is in Kansas City at the Midwest Research Institute.

(WHICH WERE ALL THE PROCEEDINGS HAD.)

STATE OF ILLINOIS)
) SS.
COUNTY OF C O O K)

I, ELDNA HUDSON, being first duly sworn on oath, certify that I am a Verbatim Reporter doing business in the County of Cook Cook and State of Illinois; and I reported verbatim the aforesaid meeting of the Task Force on Women, Minorities and the Handicapped in Science and Technology; and certify that this is a true and correct transcript of the aforesaid meeting.

Eldna Hudson

SUBSCRIBED AND SWORN to
before me this 30th day of
November, A.D. 1987.

Carol Ann Blake
NOTARY PUBLIC